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MICROSOFT'S NEW GAMES CONSOLE

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MIRACLE ANTENNAS

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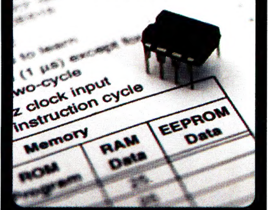

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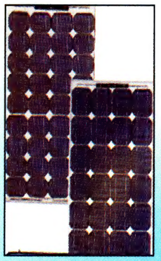

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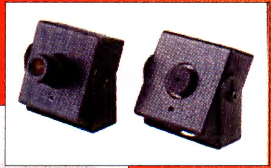

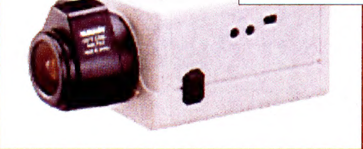

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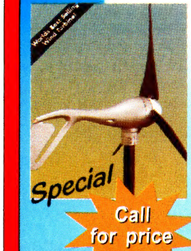

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High quality at a low price: Denon's new baby is the DVD player for the rest of us, and at a good price too.

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WHAT'S NEW

IN THE EVER CHANGING WORLD OF ELECTRONICS

THIS MONTH

- Samsung IMT-2000 Video/TV Phone
- Olympus C3030 3.3 Megapixel Camera
- JVC GC-XI 3.3 Megapixel Camera
- Hitachi VM-E308E Analog Camcorder
- Sony DCM-M1 MD Discam
- JVC GR-SX21 S-VHS-ET Analog Camcorder
- JBL Control 25AV Monitor Speakers
- Panasonic KX-TG2570ALS Cordless Phone
- Marantz PMD680 Digital Recorder
- Dick Smith Electronics Talking Clock
- Samsung YP-E64 YEPP MP3 Player
- Dick Smith Electronics ICP Solar Panels

Video on your mobile

SAMSUNG have just developed their IMT-2000 wireless service, that provides video at 15-20 frames per second. Video can come from standard video on demand services, or digital cameras can be hooked up to the handset so users can take pictures at any location and send the images wirelessly to wherever they want.

■ *Also shown is a prototype of Samsung's new TV phone, the details of which are sketchy at best... Try calling Samsung on (02) 9763 9700, but you might have more luck searching their website at* **www.samsung.com**.

3.3 megapixels arrive!

OLYMPUS has introduced the Camedia C-3030 ZOOM compact digital camera. Featuring a 1/1.8 inch CCD with 3.34 million pixels, the new flagship is the series' first model in the 3-megapixel class.

The C-3030 has a broad range of functions, including many that have won wide acclaim for the earlier C-2020. As well, the 3030 offers added creativity and flexibility; it can record audio input as well as images, and the high-speed Sequence Mode uses new SDRAM – the same kind used in PCs - to shoot SUXGA images (2,048 x 1,536 pixels) at a maximum of 3.1 frames/sec. There are also the convenience and speed of USB connectivity and many other new features.

The C-3030 ZOOM has a 1/1.8 inch CCD with 3.34 million pixels, and a bright Multivariator 3x zoom lens which makes the most of this potential with its large f2.8 aperture. Performance is also enhanced by a range of features including a new iESP AF system, Digital ESP Metering, iESP Auto White Balance and other exclusive innovations.

This is also the first Camedia model with an audio recording capability. Sound can be captured simultaneously with a moving image, or an audio note can be added to a still image. Using BGA technologies, Olympus has developed compact 32MB SDRAM for the C-3030 ZOOM – the key to recording up to five SUXGA images (2,048 x 1,536 pixels) at high speed. Sequence Mode shooting is as fast as 3.1 frames/sec., and Standard Mode recording has been speeded up as well. This response offers extra reassurance that an opportunity will not be missed, even with the increased size of high-quality images.

■ *As well, the new long-life LB-01 (CR-V3) lithium battery packs offer the freedom of lasting 1.5-2 times longer than nickel metal hydride batteries. For further information, contact R. Gunz Photographics on (02) 9935 6600, or email gunzmail@gunzphoto.com.au.*

JVC has 3.3 megapixels too

JVC HAS INTRODUCED their new GC-XI digital still camera. On the outside, this product looks remarkably like a high-grade compact film camera, but it is actually something quite different - not a conventional film camera, and not just a compact digital camera either; inside it features a 3.34 million pixel CCD which delivers high resolution digital still images, including a maximum image size of 2032 x 1536 pixels. Also featured are 3 unique JVC technologies, namely a Mega Pro-Still mode which increases resolution dramatically, NR Pro-Still mode which boosts the signal-to-noise ratio by 9dB, and DR Pro-Still mode which delivers 'latitude' that approaches film quality. And as a substantial bonus, this digital still camera comes with creative functions that go beyond conventional still shooting, including the ability to shoot video clips up to 20 seconds long that make convenient e-mail attachments.

Then there's the built-in Collage function that lets the user add layer upon layer of additional visual elements to create interesting pictures that would usually require a computer with advanced graphics processing software.

■ *For more information, contact JVC on 1800 225 044, or visit* **www.jvc-australia.com.au**.

New 8mm camcorders

HITACHI have announced three new 'made in Japan' 8mm camcorders, positioned to give the budget conscious consumer outstanding performance at reasonable cost. Hitachi also announced that these three analogue camcorders will be followed later in the year with new Digital 8 models, and a unique DVD disk based Camcorder for those wanting direct computer convergence. The new 8 mm cameras feature advanced DSP processing and enhanced Digital features resulting in improved images and ease of use.

The entry level Camcorder model VM-E308E incorporates many of the basic features found in all the new 8mm range. Primarily Hitachi's new 4DQ or 4 point Digital Quality System is designed to offer 8 mm users many of the benefits of DV video at low cost, using the new one-chip Hitachi DSP processor.

The new VM-E368E features a new compact case, long life Li-Ion batteries, 0.1 Lux sensitivity, advanced digital effects and the ability to play back both PAL and PAL60 recordings. The VM-E568LE boasts all the features of the VM-E368E plus the inclusion of a high-resolution 2.5" LCD, and automatic backlight control depending on ambient conditions.

The top of the range Hitachi VM-H768LE includes a number of technology features that position this Hi8 camera close to that of a high end DV camera at much lower cost. Firstly this new camera features Tape Analyser, an automatic system that analyses the actual tape being used in the camera and adjusts recording parameters to suit, resulting in an improvement in S/N by up to 20%. However of most interest is the new Tape+ feature that permits 400 line Hi8 resolution while using standard 240 line 8 mm tape, a big cost saving!

■ *These three new 8mm Camcorders are available now with RRPs of: VM-E368E $819, VM-E568LE $999, VM-H768LE $1,499.*

Touchscreen Camcorder

BE A HOLLYWOOD DIRECTOR! Maybe... Sony Electronics VP, Jay Sato, demonstrates how to be your own movie director with Sony's innovative MD-Discam DCM-M1 camcorder. Sony's disc-based digital camcorder uses a touch screen LCD for video editing of thumbnail images, allowing you to add titling and special effects to your home video. And you can do it all in the palm of your hand!

■ *Its available in the US now, so pester the Australian division of Sony to see when it is going to be available over here... Phone the Sony Customer Information Centre on (02) 9878 9712.*

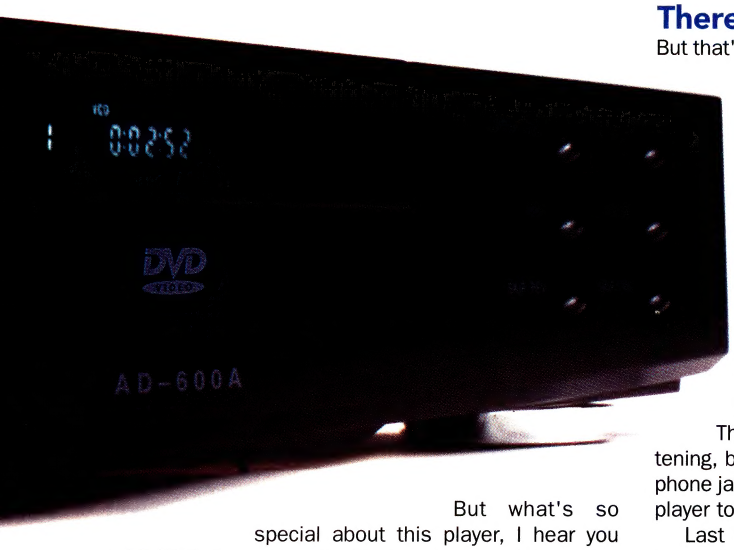
Hiteker AD-600A DVD, CD-R & MP3 Player

It's new to the Australian market, it's very aggressively priced and it has quite a few other attractive features as well -- including the ability to play MP3 compressed digital music files. **by Jim Rowe**

IF YOU'RE STILL in the market for a DVD player (and many are), there's a new model on the local market that you might well want to consider. It's saddled with a rather weird brand name – Hiteker – but on the positive side it has so many attractive features and offers such unusual value for money that its name is neither here nor there.

Like many of the latest DVD and CD players, the Hiteker AD-600A is made in China – in this case by the Jiangsu Hongtu High Technology Company. I've never heard of them before, but I gather that virtually the same player is being sold in the USA as the Apex AD-600A, and very similar models are sold elsewhere carrying the brand names Sampo, Norika, Raite, Monyka and Olidata. And whatever the name they've created quite a stir, wherever they've appeared...

THERE'S A SPECIAL 'BONUS FEATURE' I CAN'T TALK MUCH ABOUT...



But what's so special about this player, I hear you ask? Well, for a start it offers pretty surprising value for money, even as a DVD and video CD player. For example it offers not only composite and S-video outputs but the higher-quality component video (Y/Cb/Cr) outputs as well. That's something that few if any other low-end players offer.

On the sound side, like most DVD players it has a mix-down decoder for listening to Dolby Digital, MPEG2 or PCM tracks in stereo, or for external Pro-Logic surround decoding. But it's also DTS compatible, so you can hook an external decoder up to the coaxial S/P-DIF digital bitstream output for full surround decoding of DTS tracks as well as Dolby Digital. (There's no *optical* S/P-DIF output, though – only coaxial.)

As well as DVDs and video CDs it also play ordinary audio CDs, very nicely. All of which is quite impressive, considering that it carries the lowest RRP of any DVD player currently available: only $499.

There's more...

But that's not all, as it happens. The AD-600A also uses a laser with a wavelength of 650nm, allowing it to play CD-R discs as well. This is something that many players twice and three times its price often won't do.

Even better, its decoder knows how to handle MPEG1/Layer3 ultra compressed audio files – also known as MP3 files, and currently the subject of a lot of controversy because of their availability over the internet. So if you burn a CD-R with hours of favourite MP3 files (from your favourite CDs, for example), the AD-600 will play them quite happily from the disc. That's quite a bonus, in anyone's terms.

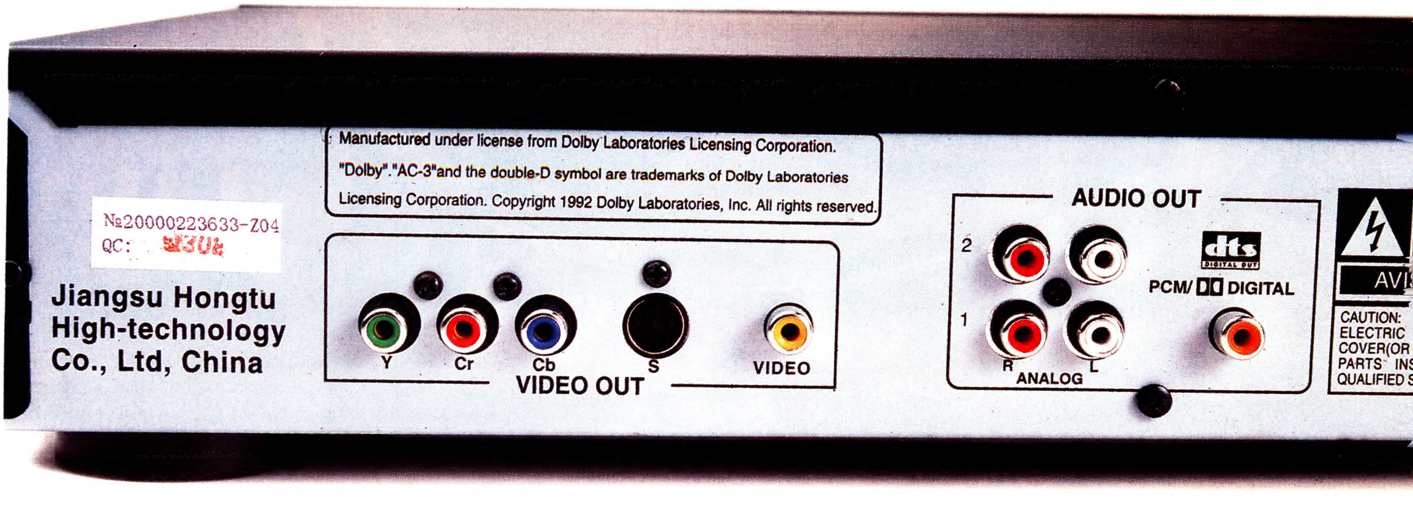
There's no stereo headphone jack for private listening, but on the other hand there *are* a pair of microphone jacks with matching volume controls, to allow the player to be used for karaoke.

Last but not least, the AD-600 offers a special bonus feature that I can't talk much about, apart from mentioning its existence. This is the ability to be set to play DVDs from virtually any region, simply by pressing a few keys on the remote control to access a 'secret' configuration menu. (Nudge, wink...)

Physically the AD-600A may not be all that prepossessing, but 'clean and functional' are the adjectives that spring to mind, and that's no bad thing. It's in a plain black case, with a moulded plastic front panel finished in gloss black, broken only by a central ruby-coloured panel over the blue fluoro type display. There are six lozenge-shaped buttons at the right-hand end for the main control functions, and just the mains switch and karaoke mic jacks and controls at the left-hand end. The overall dimensions are 430 x 300 x 81mm, and it weighs 3.3kg.

Inside, the build quality appears to be quite respectable and at least on a par with most sub-

As well as composite and S-video outputs, there are component video outputs too – unusual in a budget player. No optical bitstream output, though, only coaxial.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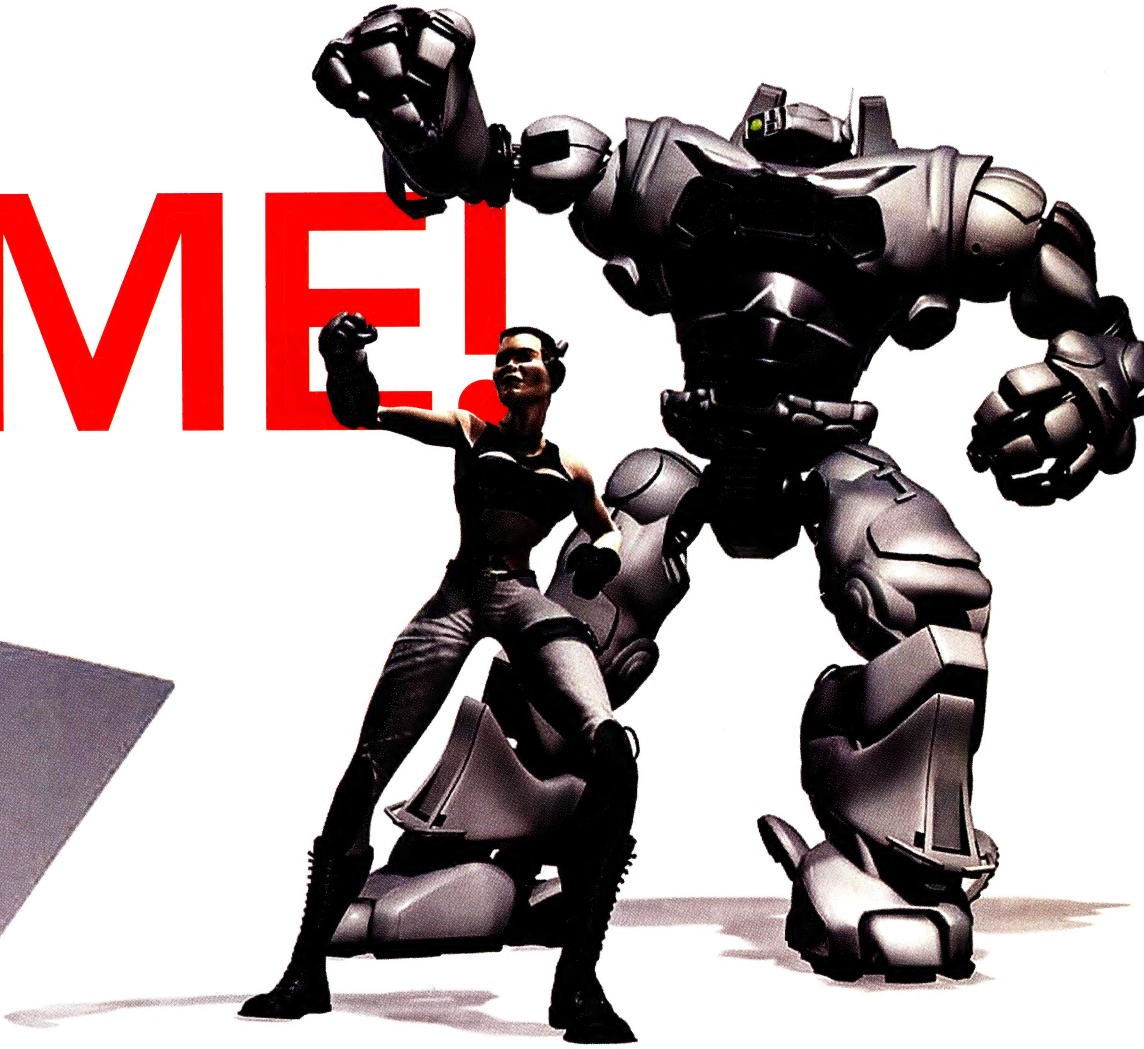
From **Pong** to **Pokemon** and beyond...

IT'S PLAY

Frequent Flyers close up those notebooks, Road Warriors put away those Palm Pilots, and cyber-caffeine fiends unplug that cable modem, its time to take a serious look at the addictively fun side of technology -- that is, the world of video game consoles. **By Mike Wilcox**

TIME!

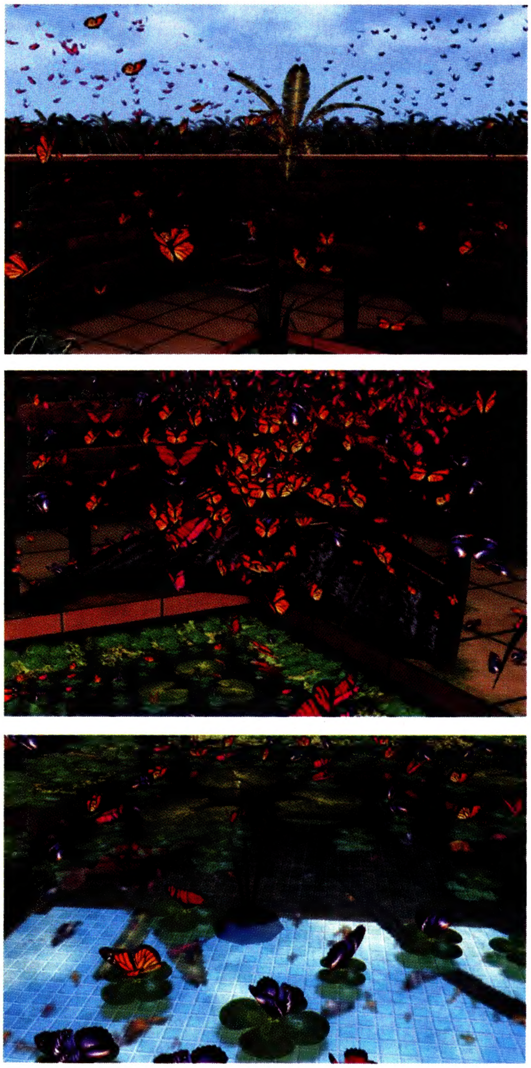


IT SEEMED that in the beginning, the typical person drawn to these silicon filled boxes of chips and bits was no more than your average adolescent male, though it's a completely different story today. As we welcome in a brand new century, along with it comes the promise of the most sophisticated and realistic video gaming experience ever.

Traditionally, video game consoles had been designed with one aim in mind, to bring the action of arcade entertainment into the home. The arcade game pioneers of the eighties, such as Atari and Sega, realised the home market potential of their coin munching monsters, and were soon developing scaled down family friendly versions of their table top and upright giants. These offered people the chance to enjoy their favourite games from the comfort of their own homes. From the paddle bat and bouncing ball basics of Pong, and the wireframe graphics of classics such as Battlezone and Asteroids, right up to the infamous Space Invaders and Pac Man, these early icons of computer games helped pave the way to what is now one of the highest grossing forms of electronic entertainment in the world today.

The corporate struggle for global dominance over the console market through the 80s and 90s saw the leader's baton changing hands several times. This was mainly due to the progressive development of new technology, that offered consumers new and improved consoles and the promise of bigger and better looking games. These advances were nowhere near as frequent as the leaps and bounds of PC technology (which manages to double in computing power every 18 months), as games consoles only pass these milestones around every five years.

The 70s and 80s played host to consoles with first generation technology dominated by 8 bit and 16 bit processors, then with the 80s and 90s came the introduction of 32-bit and 64-bit machines. It's only been in the past five to six years that the technology available has offered games developers the sort of hardware to create real time 3D effects, multiplayer options and the kind of mass storage required for graphically intensive games.



Thousands of butterflies rendered in real time on the Xbox. This sort of demonstration shows the power of being able to draw 300,000,000 polygons every second...

The other significant change we've seen in this relatively short period of time has been the shift in public perception towards video games. Once considered a teenagers toy to be found exclusively behind bedroom doors, these days with the average age of gamers is closer to 25 years old, it's common to see games consoles sitting alongside the VCR and TV in the living room.

From bedroom to boardroom

That's not the only move taking place. As their popularity continues to grow, games consoles have made a beeline from bedroom floors, through boardroom doors. The type of stakes now up for grabs well exceed many current forms of electronic entertainment, which has all sorts of major corporations reaching for a slice of the annual $8 billion pie.

At last count, Sony's PlayStation console had made it into over 70,000,000 homes worldwide since its launch in the mid 90s, making it the biggest selling console to date. Hardware of course is only half the story, as the actual games themselves are the real pot of gold, with the average gamer owning anywhere from 10 – 30 games per console.

The turn of the century has also helped mark another significant change, with the introduction of the next generation in video game consoles. All major hardware developers, including Sega, Nintendo, Sony, and wait for it, new kid on the block, Microsoft, have all confirmed development of consoles featuring 128 bit technology.

Sega in the lead

The race has already started, with Japanese company Sega sticking to their mission statement of being the first to offer the latest in cutting edge technology. Their console, the Dreamcast was released locally in October last year, and like every other new console, was available in Japan well before it ever arrived on our shores. The company really needed this head start on its competitors to try and regain ground in the community after the failure of its previous two systems. The obvious disadvantage to making this move is that they've now laid all the cards on the table, giving their competition the chance to do a full autopsy on their hardware, see the markets response to its features, and make any required adjustments to their own technology.

Next out of the gates was Sony with their 'not so creatively named' - PlayStation 2, which hit Japanese stores in early March this year, with the expected release date for the rest of the world in late October. It broke all previous sales records for its first day on sale, exceeding 800,000 units (it took six months to sell that many of the original console), so we can expect ridiculous sales figures the day it launches worldwide.

The other two consoles, Nintendo's 'Dolphin' (still a working title), and Microsoft's recently announced 'Xbox', are both not expected until after the second half of 2001. Although the specifications for both these machines have been readily available since their announcements, any further details regarding exact design, full features, and software titles are not being confirmed at this stage.

Dream on

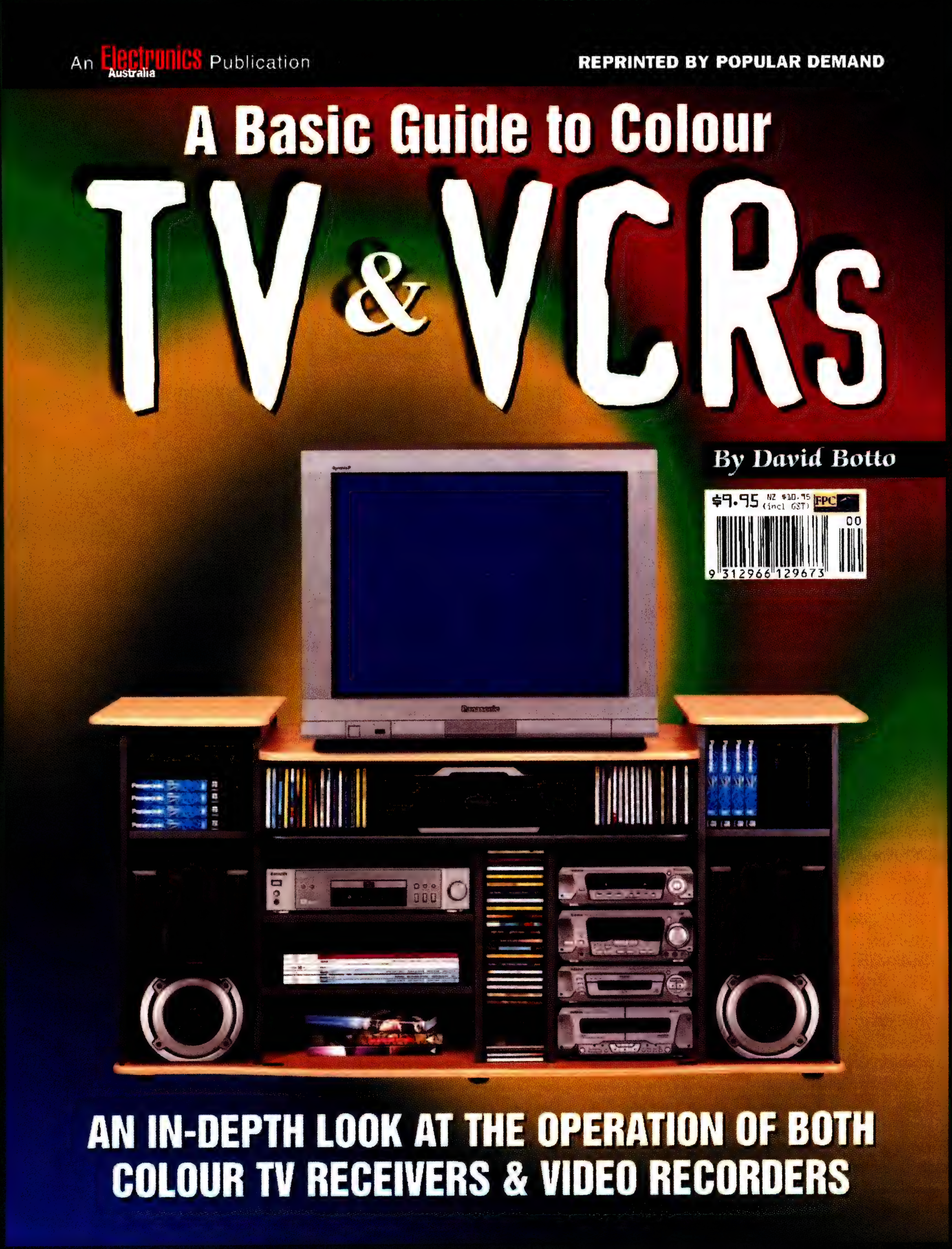
Currently, all that's on offer locally is Sega's Dreamcast. So lets take a closer look under the hood of this console first. At the centre of the engine room is a custom designed RISC CPU, specifically developed for Sega by Hitachi, that utilises a unique liquid cooling system.

This 200MHz chip can execute multiple tasks in the same clock cycle, giving it three times the performance of a Pentium II 450 CPU. This speed is also made possible through the use of other custom designed chips

BANG BANG, YOU'RE DEAD...

With the current high demand for the exporting of the PS2 consoles to other parts of the world prior to its official launch, a rather interesting scenario has arisen. The Japanese Trade Ministry had initially imposed a shipping limit on PlayStation 2 units, due to certain components in the system that classify it as a military weapon.

It was only after Sony negotiated with the Japanese government that the laws were altered, but they still forbid the exporting of the unit to Iran, Iraq, Libya and North Korea. The confirmed RRP is $US299, which could make it anywhere between $600-700 here. (Not a bad price for a piece of military weaponry!).



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Pioneer's PDR-509

CD Audio Recorder

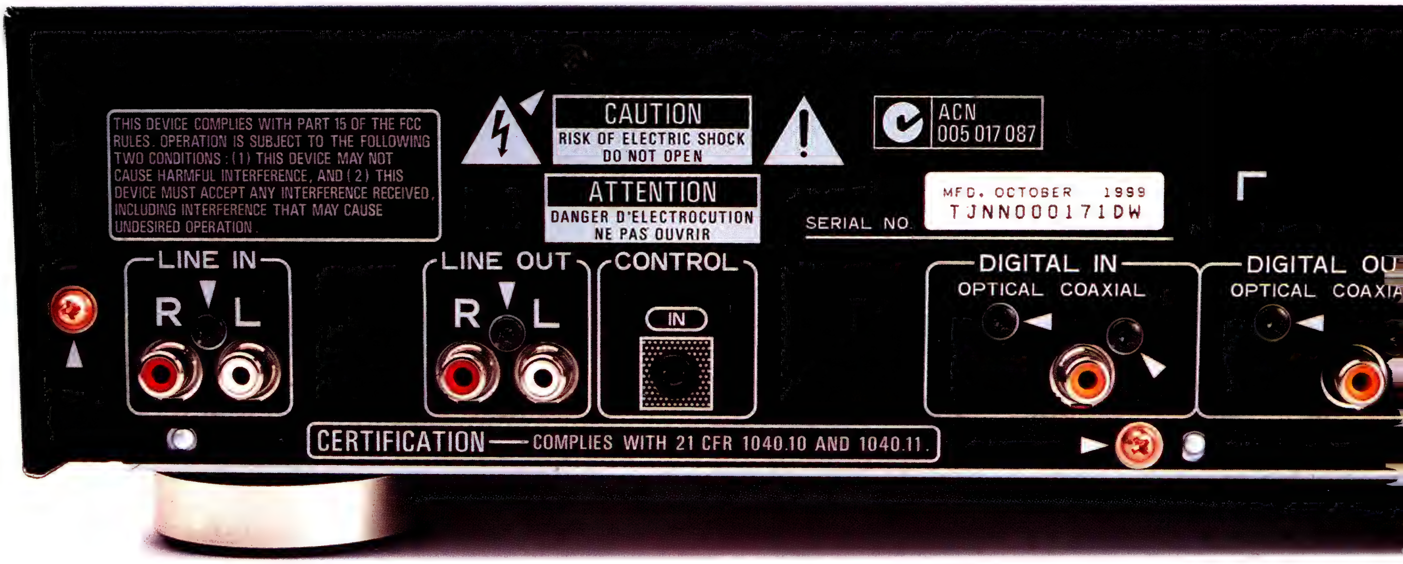
Fancy making your own audio CDs? Pioneer's new PDR-509 makes it very easy to record from either analog or digital sources. It makes high quality recordings and can even record and play on re-useable CD-RW discs. **by Jim Rowe**

NOW THAT CD PLAYERS are almost ubiquitous, compact discs make an excellent medium for high quality audio recording – they're digital, very durable, widely playable and relatively cheap. This gives them big advantages over tape-based media like DAT, or even the more specialised MiniDiscs.

You can of course record your own CDs with a PC, if it's fitted with a CD recording drive and has the appropriate software. However not everyone has a PC, and in any case this approach can be a bit involved; generally you first have to record to hard disc, and then 'burn' a disc when you're happy with the tracks. It's all a bit off-putting for people who just want to make a quick recording, and in any case it can be quite a hassle lugging your computer to a concert venue or other location...

That's where CD recorders like Pioneer's PDR-509 come in. They're fully self-contained audio CD recorders, and more or less the digital equivalent of a conventional tape deck. They'll record audio directly to a blank CD-R, and produce a finished disc which can be played back immediately on virtually any standard CD player (and many DVD players as well). In most cases they'll also play both commercial and home recorded CDs as well, just like a standard player. All of which makes them quite attractive for people who just want to make audio CDs, and as easily as possible.

There are a few more controls than on a standard CD player, but it's still quite easy to drive.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IT ONLY RECORDS ON 'AUDIO' CD-R AND CD-RW BLANKS...

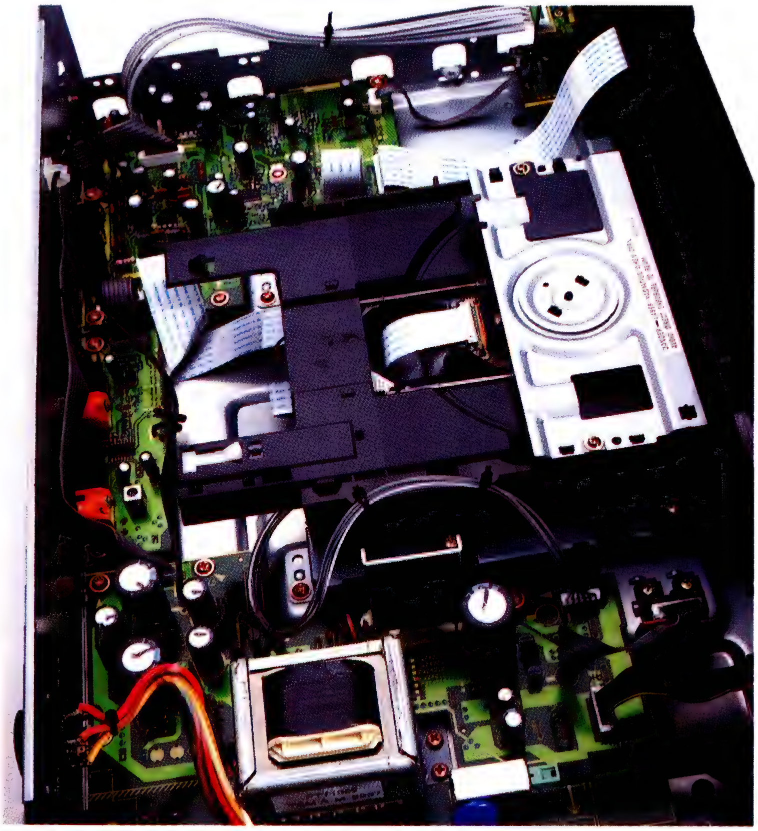
Pioneer's recorder

In the case of the PDR-509, it will record in stereo from both conventional line-level analog sources like tape decks or radio tuners, and also LPCM digital sources like CD, DAT, MD and DCC players, or even satellite receivers. For digital recording it even includes a sample-rate converter, to convert signals with 32kS/s or 48kS/s sampling to the 44.1kS/s rate used for CDs – and it will even record from an HDCD and DTS encoded bitstream.

Needless to say, it provides both digital inputs and outputs as well as the familiar analog stereo inputs and outputs. And the digital ports are provided in both co-axial and optical formats, so you have a great deal of flexibility for interconnections. You can use an optical connection from your CD or DVD player to make a digital copy of a CD, for example, or use a co-axial link to feed the PDR-506's digital output into a DAT or MD recorder.

On the analog side, the PDR-509 uses Pioneer's Hi-bit Legato Link Conversion on playback, to give what is effectively 24-bit dynamic range and an extended frequency response. I haven't been able to find any real technical information on this, but it seems to use DSP to perform digital interpolation on the 16-bit samples to convert them into 24 bits, with oversampling to allow the use of a less drastic anti-aliasing filter. It's a bit like Denon's AL24 technology, I suspect.

The PDR-509 records on both CD-R and CD-RW blanks, by the way, so you can make both write-once and rewritable recordings. But there *are* a couple of catches – one being that it'll only record on the special 'audio' versions of both kinds of discs, not the standard and widely available type used in PC disc writers. The 'audio' type carry a pricing premium which includes a royalty to the commercial music industry, on the assumption that they'll often be used to



***Not surprisingly** there's more inside than with a CD player, too.*

copy commercial recordings...

The other catch applies to the CD-RW discs, which generally can't be played on most existing CD players. So they're best regarded as being playable only on the CD recorder itself.

I should perhaps also add that the PDR-509 will basically only record from LPCM (linear PCM) audio bitstreams like those from CDs, plus those from DTS encoded audio CDs and HDCDs (High Definition Compatible Digital discs). Presumably it only records the latter in 16-bit samples rather than 20-bit, though. It *won't* record from bitstreams with Dolby Digital (AC-3) or MPEG encoding either, so you can't record CD-i, video CDs or data CD-ROMs.

There are no inbuilt microphone preamps or mixing facilities, either; just line level inputs, essentially. So for live recording you'll need a separate mixer or console.

On the other hand features of the PDR-509 do include both analog and digital recording level controls; smooth automatic digital fade-in and fade-out, using a button on the remote control; a recording mute button, to give either four-second or extended periods or silence; the ability to make synchronised recordings of digital bitstreams, when you're copying a CD for example; simple finalisation of discs after recording, to write the TOC (table of contents) and ready them for playing on a standard CD player; a built-in stereo level meter, on the fluorescent display; and a stereo headphone jack, with its own volume control.

By the way the PDR-509 implements the SCMS (Serial Copy Management System), which generally allows you to make only a first-generation digital copy from a copy-protected digital source. It will refuse to make further digital copies, although you can of course make further copies using the analog inputs.

Physically it's quite compact, and very similar in size and appearance to a standard CD player. It measures 420 x 300 x 105mm, and weighs a modest 3.9kg. The case is finished in Henry Ford's basic black, with a nicely moulded plastic front panel and a main chassis pressed from 1mm steel sheet. The steel top cover has a fine black wrinkle finish.

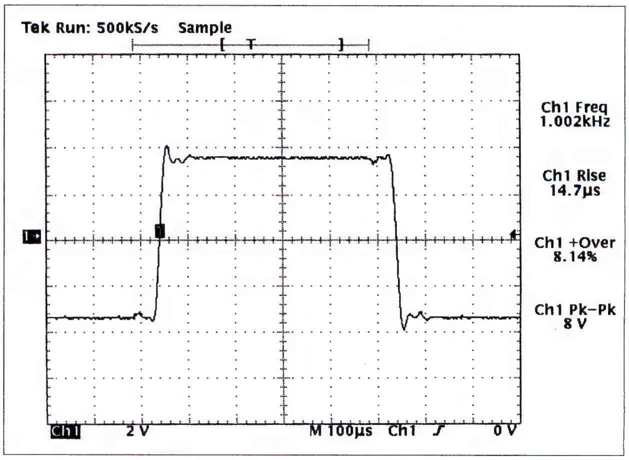
The player normally comes with matching remote control, mains cord, two analog stereo leads and a short TOSlink type optical cable. There's also a user manual written in English, Spanish and Chinese.

'Perfect' recordings?

Pioneer Electronics Australia kindly provided a sample PDR-509 for us to evaluate, plus some blank audio CD-R discs. I was therefore able to give the unit quite a thorough workout.

First of all I hooked it up to the instruments and checked its replay performance, using the usual test CDs. These showed a replay frequency response that was flat within +/-0.15dB between 20Hz and 15kHz, and drooping smoothly at each end to be only 2dB down at 4Hz and 2.3dB down at 20kHz. Channel balance was within 0.01dB. The replay signal to noise ratio measured 118dB with a dynamic range of 109dB, and the fade-to-noise test showed a linear response down to -90dB. All of which is very good, of course.

The THD (total harmonic distortion) measured 0.0035% at 1kHz, and in fact over most of the range up to 8kHz. It then had an apparent gradual rise, very small at first (0.055% at 10kHz) but reaching 2% at



***At lower right** is the replay response for a 1kHz square wave – very nice indeed.*

REPLAY RESPONSE FOR SQUARE WAVES AND IMPULSES WAS EXCELLENT...

16kHz and 10% at 20kHz. However inspection of the meter output on a scope showed it to be aliasing components, not true distortion; so it's probably not of great significance. Presumably it's a result of the slower than usual LP filter rolloff.

On the other hand the benefit of that filter characteristic, and the Hi-bit Legato Link Conversion, became apparent in the square wave and impulse reproduction. Here the performance was excellent, with very modest overshoot (8%) plus very little ringing at all; not quite up to the performance delivered by Denon's AL24 system, but very credible nonetheless.

Next I tried testing the PDR-509's ability to make digital recordings. For this test I hooked its optical digital input up to the corresponding output of my Kenwood DVF-5010 DVD player, and used the pair to make digital copies of two of my test CDs. The resulting discs were then played back on the PDR-509 to give an accurate measure of its overall digital record-playback performance.

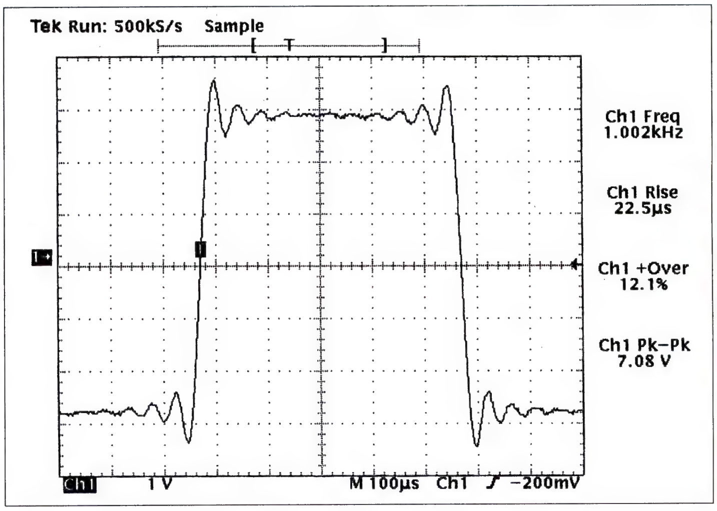
As you'd hope, the results were virtually identical with those from replay only, in all respects. Even the square wave and impulse response plots were indistinguishable from the replay only plots, showing that the digital recording operation is essentially 'perfect'.

Thus encouraged, I moved to the next testing phase: making an analog recording, to check the full A-to-D recording function as well as the replay chain.

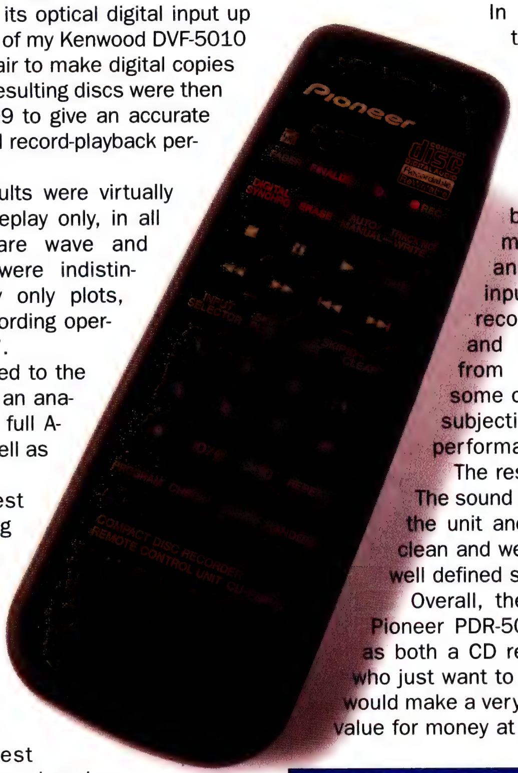
For this I recorded a test disc from scratch, using the PDR-509's analog inputs driven by either a low-distortion audio generator or my PC-driven Arb/Function generator, to produce a series of frequency response, THD and squarewave/impulse test tracks. These were then played back to measure the overall analog-to-analog performance.

The results were again very impressive. The overall response measured flat within +0/-0.3dB from 10Hz to 15kHz, rolling off smoothly at the top end to -2.9dB at 20kHz. Channel balance was within 0.2dB, with the crosstalk at close to -90dB.

The THD measured only 0.006% at 1kHz, and was in fact less than 0.007% over most of the range, rising at the top end in the same way as the replay only response. And the overall squarewave and impulse response plots were almost as good as those for replay only, with only a little more overshoot and a small amount of well damped symmetrical ringing.



***For comparison**, here's the overall analog record-play response – still very impressive.*



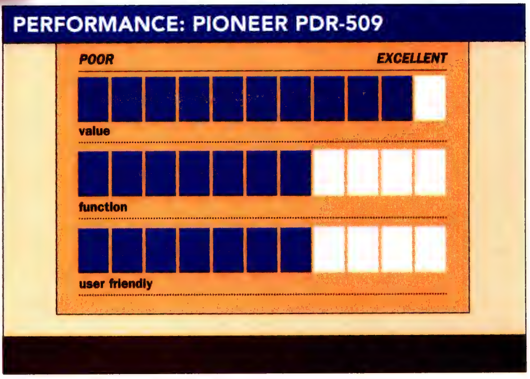
In short, the PDR-509 came through the tests with a clear indication that it was capable of very high quality recording, even using the analog inputs.

So I then moved on again, and used the last blank audio CD-R to record music tracks from both CDs and LPs, using the analog inputs. Then I hooked up the recorder to my amplifier system, and listened to both the tracks from this disc and those from some of my reference CDs, to get a subjective 'feel' for the PDR-509's performance.

The results were very satisfying, too. The sound from both the disc recorded on the unit and from commercial discs was clean and well balanced, with a stable and well defined stereo image.

Overall, then, my findings are that the Pioneer PDR-509 is an excellent performer as both a CD recorder and player. For those who just want to record and play audio CDs, it would make a very appropriate choice, and good value for money at the quoted RRP of $999. ■

PERFORMANCE: PIONEER PDR-509



SUMMARY

■ A consumer-type audio CD recorder and player.

KEY FEATURES

■ Records on both standard CD-R and rewritable CD-RW blanks.
■ Analogue or direct digital recording.
■ Sample rate converter: 32kS/s or 48kS/s to 44.1kS/s
■ Pioneer's Hi-bit Legato Link Conversion for playback.

PROS

■ Both optical and co-axial digital inputs and outputs, as well as analog stereo.
■ Excellent audio performance, thanks to Pioneer's Hi-bit Legato Link Conversion.

CONS

■ Only records on special 'audio' CD-R and CD-RW discs.
■ No inbuilt mic preamps or mixing will record a DTS bitstream as well as LPCM, but not Dolby Digital.

RRP

■ $999

AVAILABLE

■ Pioneer AV dealers, or contact Pioneer Electronics Australia on 1800 338 439.

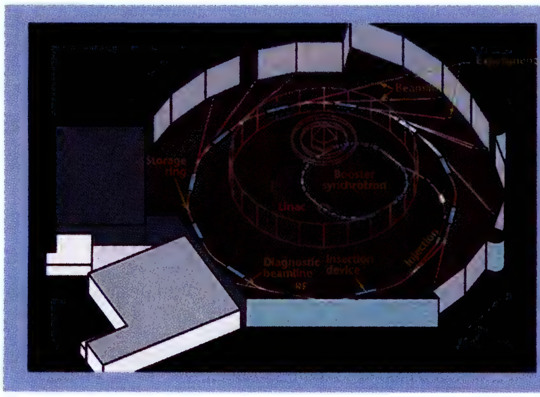
Synchrotron X-Rays Unveil Magnet Secrets

Those new ultra high capacity hard disk drives for computers have only been made possible by a new understanding of what's inside magnetic materials. Now researchers at the Lawrence Berkeley National Laboratory in California have used high energy X-rays from their synchrotron-based Advanced Light Source facility to reveal some of the deepest secrets of antiferromagnetic thin films, a key part of modern disk drive read heads.

THE PEEM2 MICROSCOPE is a new X-ray spectromicroscopy facility at the ALS, located in Berkeley, California. A couple of months ago it produced the first images of the domain structure of an antiferromagnetic thin film. The high-resolution images reveal that the alignment of tiny magnetic domains in lanthanum iron oxide, each only a few hundred nanometres (billionths of a metre) in size, corresponds to a particular orientation of the material's crystals. This and other findings hold promise for the fabrication of improved magnetic devices like the heads of computer hard disk drives.

PEEM2 was built under a joint Corporate Research and Development Agreement between the IBM Corporation and Berkeley Lab, in collaboration with Arizona State University. Researchers from the ALS, from IBM Corporation's research centres in San Jose, California and Zurich, Switzerland, and from the University of Neuchatel and Arizona State University reported their achievement in the journal *Science*.

"A modern read head uses layers of very thin films with different magnetic properties", explains Andreas Scholl, a member of the Experimental Systems Group at the ALS led by Howard Padmore. "As the head passes over the hard disk, these layers sense the orientation of the domains on the disk and cause the head's electrical resistance to change in response."



The general layout of the Advanced Light Source at Berkeley Lab. It's the size of a football field, with the PEEMS attached to just one of the many beamlines.

When the head's ferromagnetic layers share the same magnetic orientation, there is less electrical resistance than when they are magnetically opposed. In order for one layer to switch independently of another, however, one must be 'pinned' by an underlying antiferromagnetic layer, which is insensitive to applied magnetic fields.

There are many different materials with ferromagnetic and antiferromagnetic properties, "but read heads are constructed from these on a trial-and-error basis", says Joachim Stohr of the IBM Almaden Research Center in San Jose. "Nobody really knows the mechanism that couples the ferromagnet to the antiferromagnet."

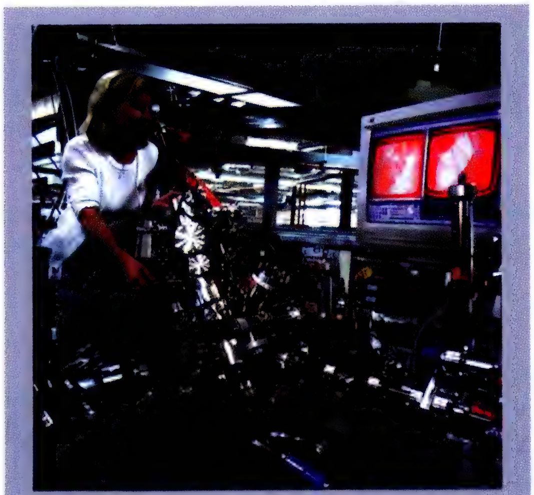
To study magnetic materials in microscopic detail, the researchers needed a tool with very high spatial resolution – and one that was sensitive to the orientation of magnetic and antiferromagnetic domains, sensitive to surfaces and interfaces, and could distinguish one kind of atom from another.

"The only method that can do all this is photoelectron emission microscopy – PEEM – using an intense beam of monochromatic X-rays from a synchrotron light source like the ALS", says Simone Anders, leader of the team that built the PEEM2.

A bright beam of X rays focused on a sample in the PEEM2 causes it to emit electrons, which the microscope focuses into an image with a spatial resolution approaching 20 nanometres. The energy of the illuminating beam can be tuned to pick out specific elements – for example, iron emits electrons with most intensity when the photons in the beam have an energy of about 710eV (electron volts).

The soft X-ray beam can be polarized circularly or linearly. Circular polarization is used to image ferromagnetic materials, whose domains have their magnetic spins aligned in the same direction. To image antiferromagnetic domains, in which spins are aligned opposite to each other, linear polarization is needed.

When the electrical axis (E-vector) of the linearly



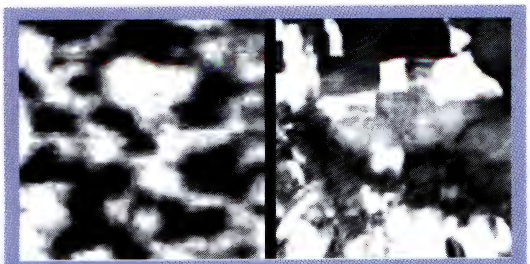
ALS researcher Simone Anders uses the PEEM2 microscope to study the orientation of magnetic domains in a sample of antiferromagnetic material.

polarized light is parallel to the spin axis in a domain, the beam excites electron emission which shows up brightly on the PEEM2 image; where spins are arranged at right angles to the polarized light's E-vector, the domain shows up as a dark spot. The magnetic structure of the surface can be deduced from these images.

"Without samples in which the size and the orientation of the magnetic domains are precisely controlled, we could not have obtained these images", Anders says of the crystals, which were made by Jean-Pierre Locquet's group at IBM's Zurich Research Laboratory. "The excellent quality of the Zurich samples was essential to the success of the project."

Locquet says "We originally developed this process to grow high-temperature superconductors". Using molecular beam epitaxy, single layers of lanthanum oxide and iron oxide were deposited one after the other to build up the compound.

The samples were gradually heated to make sure the images were really due to magnetism and not some other feature of the thin film. The Niel temperature (like the Curie temperature of other magnetic materials) is the temperature at which antiferromagnetic materials lose magnetism. When the thin film sample was heated in PEEM2, image contrast indeed vanished – and returned again as the sample cooled – but whereas in bulk the Niel temperature of lanthanum iron oxide is 740K (Kelvins), in the sample it was only 670K.



In lanthanum iron oxide, the PEEM2 reveals that antiferromagnetic domains (left) have the same size and orientation as twinned crystals (right).

"We think that what lowers the Niel temperature of our lanthanum iron oxide sample is structural deformation", says Jin Won Seo of the University of Neuchatel. "It's a film only 40nm (nanometres) thick, laid on a substrate of strontium titanium oxide. When an epitaxial thin film of one material is laid onto a substrate of a different material, it's almost impossible to get the two crystal lattices to match perfectly, and atoms get pushed out of place – which modifies magnetic properties."

Compared images

Perhaps the most remarkable finding of all came when Seo compared the PEEM2 images of magnetic domains with her transmission electron microscope images of the same sample, acquired at IBM's Zurich laboratory. The crystal structure of lanthanum iron oxide (perovskite structure) has a long axis, which lay in the plane of the thin-film sample along two directions at right angles. Both the size and orientation of the sample's crystal domains coincided with its magnetic domains, showing that they are closely correlated.

Part of the Advanced Light Source booster synchrotron. The circular booster synchrotron gives a 'boost' from an accelerating chamber (RF cavity) to the electrons each time they go around. In less than one second, the electrons have made 1,300,000 revolutions, and are travelling at 99.999994% of the speed of light.

Jean Fompeyrine of the Zurich laboratory remarks that this is not only interesting science in its own right, but "it shows us how we can build materials that control the size and orientation of magnetic domains. This understanding will then allow us to develop better read heads."

The next step is to study the interface between ferromagnetic and antiferromagnetic materials.

Lanthanum iron oxide is an antiferromagnetic material whose domain structure is large enough to be resolved by the PEEM2, but it is not the material used in technological devices. Eric Fullerton of IBM's Almaden Research Center explains that "in current read head devices, more common antiferromagnets like nickel oxide and iron-manganese are used."

To study those materials will require higher resolution, however. "Which is why PEEM3 is already under way", says the ALS's Simone Anders. Compared to the 20nm-resolution of PEEM2, "this improved photo-electron emission microscope will have two-nanometre spatial resolution." ■

FORUM

CONDUCTED BY JIM ROWE

Shonky electrotherapy devices: two steps forward, but a long way to go...

There have been some interesting developments in this area since I prepared the update that appeared in the April column. The ACCC has finally been able to jump on a couple of the firms making irresponsible claims, while the principal of another firm has sent the magazine a long email complaining that I'm being 'unscientific' in describing these products as 'shonky', and expressing doubt that they work...

TO SAVE SPACE, I'M not proposing to give you a long preamble here recapping on what we've presented about 'alternative electrotherapy' devices in previous columns. I'll have to assume that you've either read them already, or that you'll go back and read them if you're really interested. The main ones were in January, February, April, May, June, July, August and December 1998, January and April 1999, and the April issue this year.

You could summarise, I think, by saying that we've found most of the claims made for these devices so suspect that they evaporate as soon as they're revealed in any technical or scientific light. Which would make them laughable, if there wasn't such concern about desperately ill people continuing to be misled by them, and steered dangerously away from conventional medicine.

Anyway, let's start with a bit of good news. Since I prepared the April column, the Australian Competition and Consumer Commission or 'ACCC' has announced success in bringing to book two different firms selling and promoting these devices. The firms concerned are Listen Systems Pty Ltd and Vital Earth Company Pty Ltd – the former for its 'electrodermal screening' products that purport to diagnose all kinds of ailments, and the latter for its products making use of the claimed antibiotic action of colloidal silver.

Here's the guts of the first ACCC release, dated 26 April 2000:

PROMOTER OF ALTERNATIVE THERAPY DEVICES GIVES UNDERTAKINGS

Consumers misled by claims about alternative health therapy devices will receive refunds after Australian Competition and Consumer Commission action. Listen Systems Pty Ltd and its director Mr Stephen John Alexander have given undertakings to the Federal Court of Australia.

Listen Systems Pty Ltd markets alternative therapy systems known as the 'EQ4 Quick Check' and the 'EQ4 Computerised Electrodermal Screening'. Representations published on the Internet at http://www.listensystem.com.au included:

- *that these systems test a particular energy point and find an appropriate remedial strategy by scanning over 40,000 items stored in their 'virtual inventory';*
- *that Computerised Electrodermal Screening can measure allergic reactions to samples of specific food, pollens and other substances; and*
- *that these systems can imprint appropriate frequencies to create individually designed isopathic remedies;*

Listen Systems Pty Ltd has given undertakings to the Federal Court that it:

- *will not make representations including those set out above;*
- *will provide refunds until 30 June 2000 to persons who may have been misled into purchasing the 'EQ4 Quick Check' and the 'EQ4 Computerised Electrodermal Screening' system; and*
- *will display a corrective advertisement at the Internet site which had contained the representations.*

Listen Systems Pty Ltd's director Mr Alexander also gave an undertaking not to aid or abet or be directly or indirectly knowingly concerned in the publication of advertisements or promotional material containing representations concerning the EQ4 Quick Check and the EQ4 Computerised Electrodermal Screening systems, as set out above. Mr Alexander also gave an undertaking to attend a trade practices seminar to ensure future compliance with Part V of the Trade Practices Act 1974.

"The ACCC is concerned about the significant number of misleading or deceptive claims made being made about miracle, 'quick fix' product and so on in the health area", ACCC Chairman Professor Allan Fels said today.

And while we're at it here's the second ACCC release, dated 8 May 2000:

REFUNDS FOR BUYERS OF ALTERNATIVE HEALTH THERAPY DEVICES

Consumers misled by claims about alternative health therapy devices marketed as the 'Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' and the 'Vital Silver 2000' will receive refunds after Australian Competition and Consumer Commission action.

"THE ACCC IS

The Federal Court of Australia has made declarations that Vital Earth Company Pty Limited and its director Mr Darryl John Jones breached the misleading and deceptive conduct provisions of the Trade Practices Act 1974.

The Federal Court has granted injunctions against Vital Earth Company Pty Limited:

- *restraining it from making representations including those set out below;*
- *requiring it to provide refunds until 17 July 2000 to persons who may have been misled into purchasing 'Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' or the 'Vital Silver 2000';*
- *requiring it to forward a letter to each person who has purchased or agreed to purchase the 'Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' or the 'Vital Silver 2000', correcting the false or misleading or deceptive representations made by Vital Earth Company Pty Limited; and*
- *ordering it to pay a $9000 contribution towards the ACCC's legal costs.*

The Federal Court also injuncted Mr Jones from engaging in advertising or publishing materials concerning the Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' or the 'Vital Silver 2000'. Mr Jones has also been ordered to attend a trade practices seminar to ensure future compliance with Part V of the Trade Practices Act 1974.

Representations made by Vital Earth Company Pty Limited included:

- *that the colloidal silver produced by the Vital Silver 2000 and/or the Vital Silver 3000-Zapper kills all disease-causing bacteria, fungi and virus within six minutes of contact;*
- *that colloidal silver has no harmful side effects;*
- *that colloidal silver could be used as an antibiotic for all the acquired diseases of active AIDS;*
- *that colloidal silver is effective with more than 650 different pathogenic bacteria and virus types; and*
- *that colloidal silver has been used successfully against diseases including AIDS, cholera, diabetes, leprosy, leukaemia, lupus, skin cancer, syphilis and whooping cough.*

"The ACCC regards misleading or deceptive claims about therapeutic devices seriously", ACCC Chairman Professor Allan Fels said today. "Consumers are vulnerable when buying alternative health products because they usually do not have the specialist knowledge needed to determine whether claims about the products are true. Those unfortunate enough to have life-threatening diseases may be particularly vulnerable to claims that devices can alleviate or cure their particular conditions. It is therefore imperative that consumers are properly informed by advertising of therapeutic goods that is honest, accurate and complete".

So there's some cheering news – action at last to protect people against some of these devices, as you can see. But you've probably noticed as I did that only Vital Earth's colloidal silver related products were involved in that second action; presumably they're still free to market and promote their Clark-type 'zapper' devices which *don't* include the colloidal silver production 'feature'.

CONCERNED ABOUT THE SIGNIFICANT NUMBER OF MISLEADING OR DECEPTIVE CLAIMS..."

I don't know about you, but I find that a bit ironic, when to my mind the claims made about zapper-type devices are even more worrying than those made for colloidal silver gizmos. Still, it's *some* progress at least.

On the other hand...

Now let's turn to consider an email that was sent to EA's editor Graham Cattley not long after the April issue was published. It came from Mr Philip Braham, who runs a firm called Exclusive Products in Indooroopilly, Queensland. This company sells and promotes a range of 'alternative electrotherapy' devices, including colloidal silver devices, Clark-type zappers, Dr Beck-type 'blood cleaners' and magnetic pulsers, and also Rife-type machines which are claimed to treat many ailments via specific therapy frequencies.

As Mr Braham requested that his email be published, 'in the interests of fairness' following the April column, Graham forwarded it to me to do so. Here it is, then:

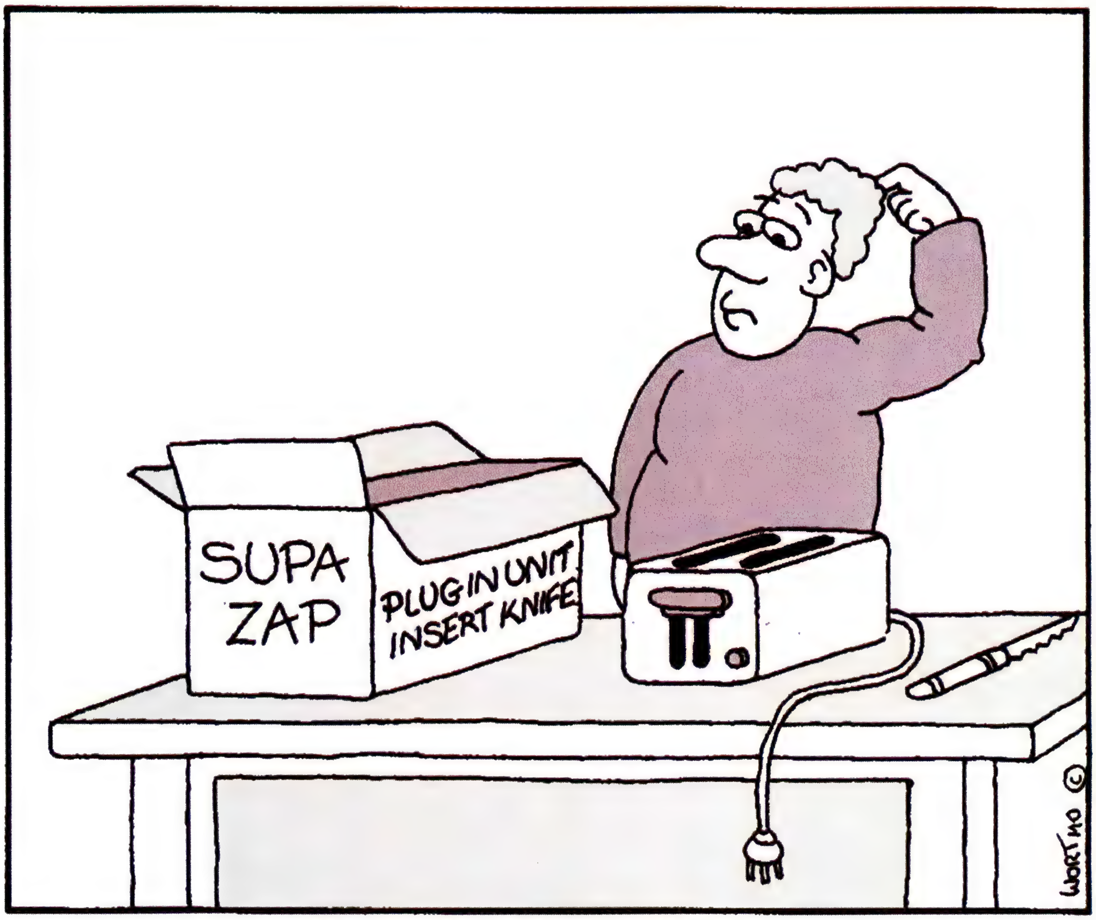
I read with some interest your article on 'Shonky' alternative therapy devices. There are a number of points that you raise that should be addressed. In addition, I feel that you have been misled on some points.

*Cheryl *** purchased the Rife machine from us and we assured her that all our products have an unconditional 30-day money-back guarantee (how many doctors offer that on their treatments?). She purchased the machine for $1200 (NOT $1600 that was stated in your article) and subsequently returned it for a refund. Despite the fact that she returned it well outside of the 30-day limit and despite the fact the machine had been dropped and was returned broken, we refunded her the money in full. I was wondering if it was broken when she tested it, but it appears from the article that she didn't even bother to use it.*

There are so many assumptions and so much misinformation in an article that depends purely on emotive terms (eg: 'Do people have to die because they have fallen to plausible sounding sales pitches'?) that I can't, in one letter, deal with them all. However the following points should be made:

The columnist seems to assume that people who purchase alternative health products are duped by a cunning sales pitch and salesmen who are interested just in making money. The machines are sold for research purposes only and generally the people who purchase them use them to investigate the effects of electrical frequencies on biological activity. In my experience, most are intelligent individuals who want to research alternative therapies, or who have received no help from conventional medicine. We always advise people with ailments to consult their medical practitioner first and we tell them that we have an unconditional 30-day money-back guarantee. A surprising number of people (surprising to me, that is) say they are skeptics but have seen the results obtained by friends and want to try the machines for themselves. It is strange that you should attempt to prevent research whilst purporting to support science.

The word unscientific does not mean nonsense. Some meanings of 'unscientific' are 'that which has not been approved by the scientific community' or 'anything that has not passed a peer review process'. If the lat-


SUPA ZAP
PLUG IN UNIT INSERT KNIFE
WORTHO ©

Alternative Electrotherapy

ter then we would have to say that immunisation and chemotherapy, to name but two commonly accepted treatments, are unscientific. On the other hand we would have to say that homeopathy is scientific – a supporting paper passed a peer review process and was published in Nature magazine. I should point out that when it was realised that the article supported homeopathy it was withdrawn by Nature magazine, which really makes a mockery of the idea of 'science' as being objective. It may make good copy but hiding behind the word 'science' in this way reduces the debate to a religious one, comparable to the burning of witches.

The treatment rate for Chemotherapy varies depending the type of cancer but for some types it is only 2 to 3 percent (John Cairns, 'The Treatment of Diseases and the War Against Cancer', Scientific American, November 1985). On these figures for survival (and there has been no double-blind tests of chemotherapy against a control) a placebo appears to be more effective in many instances. For Pancreatic Cancer even the American Cancer Society admits that by the time the disease is detected there is no effective cure. Are you going to prevent the use of alternative therapies in these situations?

Your report that the 'most worrying' (to whom?) information that the New Zealand inventor-therapist who 'claimed' to treat a boy of cancer is coming to Australia, is rather odd. On any factual basis he DID cure the boy. Why do you say 'claimed'? Can we then say that doctors 'claim' to treat patients? The usual ploy here is to assert that cancers cured by alternative therapies had a spontaneous remission!

In this article you make no attempt to analyse the machine, the treatment or even talk to people who have had very successful results. I suppose that you assumed that judicious use of terms like 'shonky' and 'unscientific' would suffice to satisfy your audience in place of facts. In a previous article you analysed machines and found some of them to be frequency generators. Of course! Had you asked the suppliers they *would probably have told you that without you going to the trouble of 'revealing' it.*

Asking a doctor imbibed in conventional medicine whether it would work is absurd. What do you expect him to say? And asking an electronics expert if such a machine could cure diseases is akin to asking a pop star for their opinion on global warming – it makes good publicity and fools the gullible but it is not science.

Are you familiar with a defibrillator – a machine that doctors claim can revive the dead? Were you to dissect one of this machines you would find it to be no more than a sophisticated high-voltage frequency generator.

It is interesting to note that the strongest selling books in medical school bookshops in Australian universities are books on alternative therapies. As my own (conventionally trained) doctor put it "...these naturopaths are way ahead of us. What they do now, we will catch up with in 5 years time".

There are countless examples of accepted therapies that were first introduced by alternative therapists. TENs machines, acupuncture and the beneficial effects of the herb Ginkgo Biloba are just three that come to mind. If I was want use the emotive language of your columnist I may ask 'how many people will suffer as a result of suppressing research into alternative therapies'?

It is depressing that publications such as yours should resort to emotive language under the guise of science. Real science involves objective observation – something your columnist hasn't even attempted.

Well, there you are. Mr Braham's 'correction' has been published, in the interests of fairness. I'm not even proposing to comment on much of what he's written, either; I think readers will be well able to make up their own minds as to the logic or consistency of what he is claiming.

For example I doubt if too many readers will find his claim that these devices are sold 'for research purposes only' particularly plausible. Frankly it sounds like a rather cynical cop-out – a bit like the Japanese whaling industry, and its claim that they kill all those whales 'purely for research purposes'...

I *was* quite concerned, though, about his claims that our correspondent Cheryl had acted in a misleading manner with regard to the Rife machine mentioned in the April column, which had been purchased from Exclusive Products and subsequently returned. That's because in all my correspondence with Cheryl I've always found her scrupulously honest, and motivated only by a desire to expose products which she believes are dangerously misleading.

So as soon as I became aware of Mr Braham's claims concerning her and the Rife machine in question, I wrote her a note asking for her side of the story. Here's Cheryl's response, which I believe it's only fair to publish in the same column as Mr Braham's allegations:

Jim, of late the little NZ boy Liam has been my inspiration since first learning his story on '60 Minutes' and the NZ press in May 1999. Having 'investigated' the Rife industry in Australia since 1993, I vowed last year to do all I possibly could to see that all the true facts about past and present Rife machines, and the modern Rife industry, were put on public record. Ideally on the internet, where it would be freely available to everyone.

I was unable to raise the funds to buy the machine for my Rife research. I could not afford to keep it, so had to return it for a refund. In June 1999 I had sent $1200 for his advertised basic 'Rife Machine'. He sent me the $1600 advanced unit.

Mr Braham never told me that I had supposedly dropped and broken his machine; I didn't. In October 1999 I returned it, packed in the same box/packaging as supplied by Mr Braham. This $1600 value metal cased machine had been sent to me packed in loose foam fill in an old cardboard box, slightly wider and deeper (about 6mm) than the machine, with the large heavy metal (5mm thick) footpads loose in the box.

Mains power operated, it had no manufacturing name or licence panel, nor any electrical specifications or safety approval. In fact it had no 'Rife Machine' name plate, only one reading 'General Applied Electronics – ph. (07) 3256 7874' on the front panel. There was no glossy colour product or user manuals, nor any warranty; only seven pages of A4 copy paper with 50 codes (from 00 to 49) and their frequencies (0.67Hz to 10.000kHz), and hundreds of diseases and their frequency codes.

After seven weeks of protests, five A4-copy pages arrived, titled 'Electrotherapy Instrument – User Manual' and along with a warranty. The machine's designer-builder Bogden Figura, a Queensland-based electrical engineer, told me that he "didn't put 'Rife Machine' labels on the machine or product materials, to protect himself".

Both Mr Braham and Mr Figura told me that their Rife machine was similar to the NZ Quantum Booster (QB) machine shown on '60 Minutes' (May 1999) that had 'cured' the little NZ boy's cancer. But neither man could tell me what was Dr Rife's specific cancer killing frequency, and astoundingly neither can anyone else in the Aust/NZ/USA Rife industry that I have contacted.

A recent update on '60 Minutes' reported that Liam's cancer has advanced; i.e., the super Rife-QB machine did not cure him after all. His parents fled to Mexico; that failed. Then they went to Germany, where they finally accepted chemotherapy; but the doctors said it was 'too little, too late'.

For your interest I attach copies of all the 'documentation' that came with the Exclusive Products machine, and also of the correspondence with Mr Braham. As you can see, at no time did he mention that it was damaged when returned. My opinion is that this is just a very cheap attempt by Mr Braham to discredit me.

Thanks for those comments, Cheryl. I think they give most of us all the reassurance we need regarding your own credibility and motives, and inevitably weaken quite a few of Mr Braham's claims.

But that's about all we have space for this month. I'll try to present some of the other material that Cheryl sent soon, though, because I think you'll find it interesting. I know I did. ■

Jaycar ELECTRONICS

Prices valid until
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As easy as ordering a pizza!

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OVERNIGHT DELIVERY

AURA™ INTERACTOR™

BODY BLASTERS

If you thought subwoofers generated low-bass frequency, we guarantee these products will challenge your thinking about sub bass products. These interactors were designed to be used with games consoles such as Sony Playstation and Nintendo 64, as well as PC games through a soundcard.

The cushion version is ideal for throwing on the lounge where you enjoy your Dolby sound movies. By strapping the backpack on, or sitting against the cushion, containing an electrodynamic transducer, the user literally feels through their body every crash, kick and explosion generated by the game being played, or the movie being watched.

PRICES SLASHED

jaycar
BOOM!
BOOM!

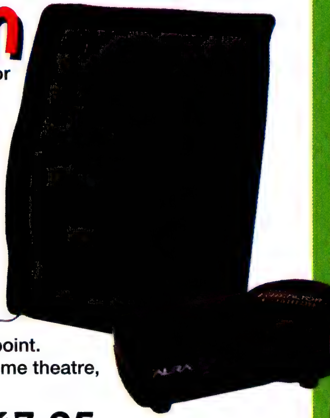
BACKPACK

The backpack is more suited to games machines for kids as it can be strapped on to their back for walkaround action. The backpack includes connecting leads for the Playstation and N64.

Cat. XC-1000

WERE $269 THEN $49.95
NOW ONLY $29.95

CUSHION



The cushion is ideal for home cinema. Simply place one where each person sits, and feel all the action through your back. The cushion is black and won't look out of place in/on most louges. Pillow size is approximately 320mm wide x 420mm high by 80mm thick at its deepest point. Includes connecting leads for home theatre, TV, Playstation & N64.

Cat. XC-1005

WERE $47.95
NOW ONLY $29.95

Some of the cartons are slightly scuffed, but the contents inside are perfect!

LOWER PRICES ON CDR'S

Jaycar Platinum Bulk CDR
Cat. XC-4716
No Jewel Case

1 pack(10 Discs) $15.90
10 pack (100 Discs) $143.10
WAS $21.55

Avalon Platinum CDR
74Min. Cat. XC-4715

Philips Gold
Cat. XC-4711
74Min.

Avalon: Now $1.90
Buy 10 $17.00
WAS $2.73

Philips: Now $2.85
Buy 10 $25.65
WAS $3.25

Mitsui Gold
Cat. XC-4709
74Min.

Now $2.95
Buy 10 $26.55
WAS $3.79

Laser 80min CDR
Cat. XC-4713

Now $2.95
Buy 10 $26.00

Rewritable CD-RW
Cat. XC-4720
74min

Now $4.95
Buy 10 $44.55

Arita Digital Audio
Cat. XC-4705
74min CDR for digital audio only.

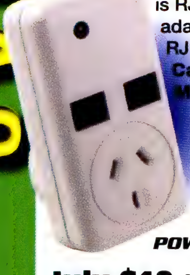
NEW

Only $4.95
Buy 10 $44.55

PHONE/MAINS FILTER MADNESS

Grab one in July, and save. 1 month only at these low prices

Single Outlet



Phone socket is RJ45 with adaptors for RJ12.
Cat. MS-4025

Cat. Price $24.95

POWERTECH

July $19 Save $5.95

6 Outlet

6 mains sockets and one phone socket - RJ45, with RJ12 adaptors. Includes on/off switch and circuit breaker, surge protection etc. See Cat. page 157 for full details.

POWERTECH

Cat. MS-4035

July $36 Save $7.25

CAR STEREO CASSETTE MECHANISM

AN EXPERIMENTORS DELIGHT

We have a strictly limited quantity of a fantastic car cassette mechanism. These are brand new, and are made in Japan under licence from Staar, Belgium. They feature a stereo head, fast forward, reverse and auto eject. Specifications: Tape speed 4.75cm/s; Wow and flutter 0.25%rms: Size 200(D) x 205(W) x 40(H)mm approximately. We supply basic information with the mechanism. There is also a full set of specifications available for $25, which includes 33 pages and 5 x A3 pages. Be quick, limited quantity, and they won't last. Cat. AR-1500

NEW

Only $15

6 VOLT SOLENOID

These solonoids, are made made in Japan. They are 6 volt, 10 ohms, have a 10mm movement. Size is 38 x 20 x 25mm. Limited quantity. Less than 1/2 normal price.

Cat. SS-0908

NEW

Only $3.95

Internet Timer

NEW

Keep track of the time you spend on the Internet with this clever timer and minimise your ISP bills. The unit mounts on top of your monitor and has two timers to keep track of total elapsed time and the current session time. Also ideal for computer operators, desktop publishers etc, who charge their labour on an hourly basis.

Cat. XC-0120

ONLY $29.95

Don't Forget To Check Out Our Website: www.jaycar.com.au

PROFESSIONAL 1/3" COLOUR CCD CAMERAS

With Panasonic Sensor, Audio & Auto Iris Option

NEW

This new camera has 420 TV lines resolution. Features include:
- PANASONIC 1/3" CCD SENSOR for super high quality and long life
- Inbuilt high sensitivity microphone
- Will accept auto iris lens or standard C & CS lenses. A quality camera. •Auto iris: Video type / DC type switchable •Microphone: High sensitivity •Power source: DC12V +/-10% •Current consumption: 90mA •110L 60H x50

Cat. QC-3302 **$329**

Dome CCD Camera With Panasonic Chip

NEW

This high quality camera has 420 TV lines resolution, and the 1/3" Panasonic Chip for extremely long life and high reliability. It offers excellent reproduction with low lag and high burn resistance. •Load impedance: 75Ω •Standard board lens: f3.6mm/F2.0 •Lens angle: 92° •Size: 87(Dia)x72 (H)

Cat. QC-3303 **$329**

SPECIFICATIONS COMMON TO BOTH CAMERAS:
- Pick up elements: 1/3" PANASONIC CCD image sensor
- Number of pixels: 512(H) x 582(V)
- Resolution: 420 TV lines •Min. illumination: 1 Lux / F2.0 •S/N ration: More than 48dB
- Electronic shutter: 1/60(1/50) to 1/100000 auto •Power source: DC12V +/-10% •Current consumption: 90mA

NETWORK YOUR COMPUTERS

NEW

ITS EASIER THAN YOU THINK! Share your printers with other users, access files on other machines, even share your internet access on all your computers (addittional software required). Link your computers together using one of our fantastic networking bundles and you'll wonder how you got on without it. Ideal for home or small business.

BUNDLE 1: Low cost 10Mbps 10Base-T kit links 3 machines together and has connectors for a total of 5!

•5 Port Hub Cat YN-8070	$76.57
•Combo Card Cat YN-8060 x 3	$103.95
•Patch Lead (2m grey) Cat YN-8142	$8.57
•Patch Lead (5m red) Cat YN-8114	$12.69
•Patch Lead (10m blue) Cat YN-8105	$21.98
Total (Normally sells for):	$223.76

only $189
Save $34.76

BUNDLE 2: Fast, 100Mbps 100Base-T kit for 3 machines (max 4).

NEW

•4 Port 100Mbps Hub Cat YN-8080	$190.58
•10/100 UTP Card Cat YN-8062 x 3	$114.78
•Patch Lead (2m grey) Cat YN-8142	$8.57
•Patch Lead (5m red) Cat YN-8114	$12.67
•Patch Lead (10m blue) Cat YN-8105	$21.98
Total (Normally sells for):	$348.58

only $299.50 Save $49.08

You'll be surprised how easy networking can be.
If you need a little help, it is fully covered in Silicon Chips computer omnibus. (Avail. separately at only $10.95 Cat BS5065).

3-15 VDC 40 Amp Switchmode Bench Power Supply

This power supply weighs only 3.5kg! It features variable output voltage 3 - 15 VDC, with a fixed voltage output of 13.8 VDC. And the 40 amp current is CONTINUOUS.

Powertech
Cat. MP-3090 **$379** NEW

Dual Output, Dual Tracking Laboratory Power Supply

NEW

This is a precision power supply that is effectively two 0 - 40VDC 3 amp power supplies in one case. The two outputs can be operated independently, or switched to 'dual tracking' mode to provide 'master' and 'slave' outputs. The outputs can also be strapped together to provide up to 80VDC @ up to 3 amps or 40VDC @ up to 6 amps. Course and fine voltage controls are provided on both outputs, as is current limit control. Each output has independent digital voltage and current meters.

Cat. MP-3092 **$439**

Machined Aircraft Grade Water Resistant 2 x AA Aluminium Torch with Push on/off Switch

NEW

This is a quality water resistant metal torch with a push button on/off switch. Also features adjustable beam and is shock resistant. Supplied with a tail lanyard, and in titanium colour. A great torch for the glovebox, bedside, toolbox or handbag.

Spare bulb ST-3055 $1.25

Cat. ST-3054 **$15.95**

DUE EARLY JULY

BUY 10 LESS 10%

"FULL HOUSE" Power Driver Bit Sets

Cat. TD-2035

Includes both Full House and Son of Full House kits i.e. 64 odd driver bits to suit most odd screw heads.

FULL HOUSE	**$13.36**
SON OF FULL HOUSE	**$12.40**

JULY BUY BOTH FOR ONLY $18

Cat. TD-2036

Jaycar will match or better the price of any product our competitors sell, provided the goods are in stock, and of the same quality. Sale Prices Included.

IDE Mobile Hard Disk Case

Cat. XC-4670

NOW WITH FAN

$28.75

2.5" QUALITY SPEAKER

This speaker has a huge magnet for its size, has a square frame and is 8Ω impedance. We think power handling would be around 5 watts. Small speakers like this are rare. Limited qty available. Cat. AS-3026 **$9.95**

NEW

Last chance to buy a CRO at these Prices

Buy yourself that new CRO in July. It's your last chance, because due to the $A, these will increase from next month. See Cat pages 44/45 for full details.

20MHz Hung Chang

$699 Cat. QC-1908

40MHz Dual Trace

$865.50 Cat. QC-1901

Supplied with 2 sets of probes

SWICHMODE POWER SUPPLIES

5VDC 2 Amp Cat. MP-3230
6VDC 1.66 Amp Cat. MP-3232 NEW

Input lead requires IEC C8 Cat PS4-115 $5.70.
Output lead to 2.5mm DC Plug. **$25.95ea**

12VDC 4 Amp Cat. MP-3240
24VDC 2 Amp Cat. MP-3242 NEW

Input lead requires IEC 3 pin Cat PS-4106 $8.11.
Output lead to 2.5mm DC Plug. **$62.95ea.**

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OVERNIGHT DELIVERY

Jaycar ELECTRONICS Number 1 For Kits

MAILORDERS - FREECALL FOR PHONE ORDERS - 1800 022 888

NEW KIT!!

COMPACT FLUORO LAMP DRIVER KIT

Refer SC July 2000.
Now you can power your 240VAC compact fluorescent lights from a 12V battery! This inverter can drive loads up to 40W for CFLs with 0.95 power factor and up to 33W for CFLs with low power factor. Kit supplied with diecast box, silk screened panel and all electronic components. CFLs and fittings not supplied.

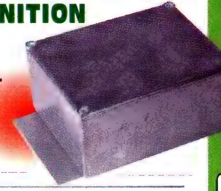
Cat. KC-5293
$79.95

30 IN 1 ELECTRONIC PROJECT LAB

See Cat page 27.
Cat. KJ-7020
$33.47

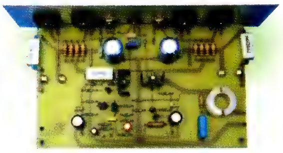
HIGH ENERGY IGNITION FOR CARS

See Catalogue page 18.
Cat. KC-5247
$47.84



100W ULTRA LOW DISTORTION AMP KIT

Refer SC March/May 2000
This class AB amplifier delivers up to 100 watts into 8 ohms. Heatsink required - use HH-8530
Cat. KC-5288
$89



Heatsink not supplied.

POWER SUPPLY KIT FOR LOW DISTORTION AMPLIFIER

Refer SC March/May 2000
Power supply PC board to suit KC-5288 amplifier module. Kit supplied short form which includes PCB and on-board components only. Details supplied in kit for purchasing toroidal transformers. Additional parts required include 4 x RU6710 8000µF capacitors, bridge rectifiers and 240V mains hardware.
Cat. KC-5289
$29.95

CD AUDIO COMPRESSOR KIT

Refer SC June 2000
Use this compressor to boost the low levels and compress the high levels of your music so it can be better heard in noisy environments including in cars, house parties and restaurants. You can use it "live" or for recording CD's to tape.
Kit includes case, silk screened panels and all electronic components.
Cat. KC-5291
$75.00

3 STAGE FM TRANSMITTER

Our most powerful transmitter. See Cat. page 11.
Cat. KD-6024
$17.19

GENUINE SPRING REVERB KIT FOR GUITAR

The old fashioned spring reverb, but it sounds good!. See Cat. page 10.
Cat. KC-5282
$76.57

MOON WALKER ROBOT

Fun and easy to build.
See Cat. page 6.
Cat. KR-3112
$69.95

ROBOT ARM

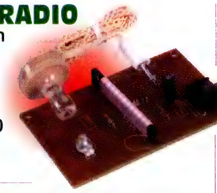
5 separate movements. Max reach 360mm, max height 510mm. Controlled by manual box supplied, or by PC with interface (KC-3104 $299). See Cat. page 4
Cat. KR-3100
$139

DI BOX

Will run on phantom power die cast box. See 99 Cat. page 6.
Cat. KA-1690
$38.26

CRYSTAL RADIO

A great start in Electronics.
See Cat. page 12.
Cat. KV-3540
$9.95



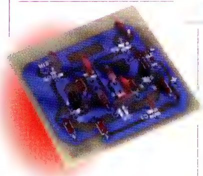
VIDEO ENHANCER STABILISER KIT

See 99 Cat. P12.
Cat. KA-1798
$69.99

MINI MITTER - FM STEREO TX

Thousands sold. Transmits stereo FM. See Cat. page 13.
Cat. KC-5041
$33.47

TV MASTHEAD AMPLIFIER



Much cheaper than buying a built one.
See 99 Cat. page 14.
Cat. KA-1810
$33.47

MIXTURE DISPLAY KIT FOR FUEL INJECTED CARS

See 99 Cat. page 16.
Cat. KC-5195 **$14.32**

DIGITAL SPEEDO / SPEED ALERT KIT

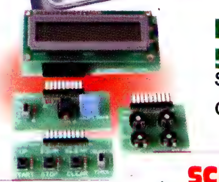
See Cat. page 16.
Cat. KC-5279
$47.84

EGO (EXHAUST GAS OXYGEN) TESTER

Monitor engine exhaust! See Cat. page 16.
Cat. KA-1758
$19.12

ULTRASONIC PROXIMITY DETECTOR

Built units cost about $100! See Cat. page 16.
Cat. KG-9158 **$23.89**

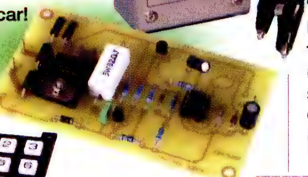


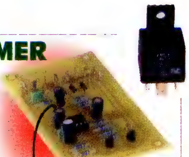
PIC TRAINER WITH 5 FUNCTIONS KIT

See 99 Cat. page 19.
Cat. KD-6060 **$104.40**

ENGINE IMMOBOLISER MK2

Protect your car!
See 99 Cat. page 18.
Cat. KC-5255
$28.68





TURBO TIMER

Keeps your turbo'd engine running for 90 seconds.
Cat. KC-5254
$28.68

SCREECHER CAR ALARM

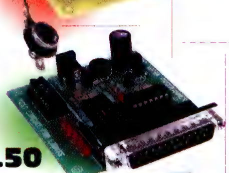
Goes off "inside" the car.
See Cat. page 18.
Cat. KA-1813
$28.68

COMBINATION KEYPAD FOR ABOVE

See 99 Cat. page 18.
Cat. KC-5257
$19.11

16F / C84 PIC PROGRAMMER

See Cat. page 19.
Cat. KD-6064 **$60.50**

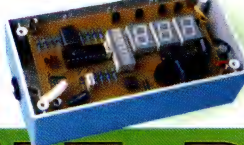


AUDIO/VIDEO TRANSMITTER

Transmit audio & video to another room.
Range 20mtrs. See Cat. page 7.
Cat. KC-5272
$38.26

SERIAL PIC PROGRAMMER KIT

See 99 Cat. page 19.
Cat. KD-6062
$35.39



DIGITAL RAIN GAUGE KIT

Refer SC June 2000 This fully automatic rain gauge is self clearing and displays up to 61 days of rainfall data on its 3 digit digital display. Kit includes all parts to make the display unit and outside rain gauge. Plastic funnel and 3 core cable required. Needs 9-12VDC use MP-4007.
Cat. KC-5292
$65.00

OVERNIGHT DELIVERY

OVERNIGHT DELIVERY

8 x AA/AAA Ni-cad Fast Charger

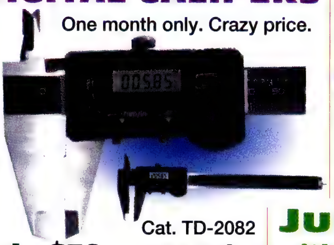
Now suited to the higher current nicads now available, including 1 amp! This charger will fast charge the batteries, then automatically switch over to trickle charge. Features •Recharges 2, 4, 6 and 8 pieces of AA or AAA at a time. •Selector switch to alter charging time for 600mAh, 800mAh and 1000mAh batteries

Cat. Cat. MB-3510 **$44.95**

Buy in July & receive 4 x 1000mA AA Batteries free. Value $13.40

DIGITAL CALIPERS

One month only. Crazy price.



Cat. TD-2082

July $72
Save $22.80

GST Price $94.80

USB PC SLOT CARD

Supplied with 2 type"A" sockets and flyleads which are 180mm long.

New Low Price

Was $23.89 **Now $12.95**
Cat. PL-0929

Jumbo Wall Clock
with Temperature and Humidity

This large format timepiece simultaneously displays time, day, date, temperature and humidity.
•The time is shown in large digits, 38mm high and can be in a 12 or 24hr format.
•Temperature, day and date digits are 23mm high and temperature can be displayed in °C or °F.
•The unit is a classy charcoal & silver colour.
•Size is 250 (W) x 190 (H)mm.

Cat XC-0234 **$69.95**

Desk Mount Magnifier Lamp

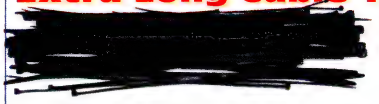
Cat QM-3525

ONLY $99

SAVE $26

This is a high quality, all metal frame construction magnifier which features a 22 watt circular flouro built inside the magnifier head. The magnifier itself is a 3 diopter lens, with a metal handle mounted on the magnifier head for quick re-positioning. Ideal for labs and profesisonals. Replacement tube $13.21 Cat ST-3014.

Extra Long Cable Tie Pack



Cat HP-1209

$14.95

10 x 500mm x 10mm wide 20 x 400mm x 5mm wide
10 x 510mm x 8mm wide 30 x 300mm x 4mm wide

Lower Prices on Cable Ties

Cat.	Size	Pkt	Was $	Now $	Save$
HP-1200	100MM	20	1.48	1.20	0.28
HP-1203	100MM	100	4.75	3.50	1.25
HP-1211	100MM	500	NEW	12.95	NEW
HP-1201	150MM	15	1.87	1.50	0.37
HP-1204	150MM	100	8.59	5.95	2.64
HP-1212	150MM	500	NEW	22.95	NEW
HP-1202	200MM	15	2.16	1.75	0.41
HP-1205	200MM	100	11.10	7.95	3.15
HP-1213	200MM	500	NEW	29.50	NEW

Wireless Audio Video Sender

Runs on 2.4Ghz. Ideal for CCD, Video, TV, LD, Cable TV! Range up to 100mt. line of sight. Refer to page 221 of catalogue. Cat. AR-1800

Use a wireless CCD camera setup!

July $199.40 **1999 Price $299.50** **Save $100**

Economy Magnifier Lamp

Was $38.26
Save $10

This magnifier lamp has a 95mm dia. magnifying glass and requires a 60 watt globe for illumination. It has an adjustable head, and can be extended to almost 1 metre. An on/off switch is located on the cable, and it can be clamped to a desk up to 35mm thick. Cat. QM-3528

July $28.26

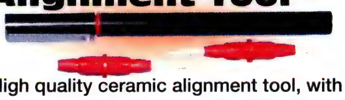
Crazy Capacitors!!

Stock up at these crazy prices. 2.0μf 250VDC polyester. Size 31(L) x 10.5(W) x 20(H)mm. Lead spacing 27mm, lead length 18mm. Cat. RG-5177

Cat. Price $29.50 July $10

Pkt. 100

4 in 1 Ceramic Alignment Tool



High quality ceramic alignment tool, with 4 different interchangeable tips. Tips include 3 slotted and 1 Phillips. Slotted - 0.4 x 0.9, 0.4 x 1.8, 0.4 x 1.3 Phillips - PH1.7 Suitable for 2 - 2.5mm coil adjustment. Cat. TH-1808

Was $21.95 **50 ONLY LEFT**
Save $7 **SELLOUT $14.95**

20 Second Voice Recorder

Record 3 separate voice messages - 8,6,6 seconds, or one up to 20 seconds. Supplied with keychain. Cat. XC-0275

99 Cat. Price $24.95
Now Only $15
80 only available

Mini 'Phone Amplifier

Increase the volume of your phone. Straps onto handset with the rubber belt. Includes a volume control. Cat. YT-6035

Cat. Price $14.32

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BY STEWART FIST

The Resonance of Towers

REGULAR READERS of this column have probably got the message by now that, while I'm worried about long-term exposures from cellphone handsets held directly against the side of the head, I don't see much in the way of dangers from the low levels of cellphone towers.

This is, of course, completely the opposite of most activist fears. It also goes against most of the sensationalism you read in the newspapers and see on television. The occasional street demonstrations are always against the siting of towers in a neighbourhood, but no one parades around Canberra complaining about the potential dangers of handsets.

From an engineering viewpoint this doesn't make sense, of course. We all know how the inverse square law operates with radio transmitters, and this calculation tells us that a 2 watt battery device held two centimetres from the side of the head can produce much higher power-densities than a 100 watt transmitter a block or two away. In fact, the difference between the two can easily be in the order of a million to one, even if the cellphone tower's beam is highly focussed.

For this reason, engineers will usually look at these figures and decide that they need investigate potential health effects from towers no further, and that certainly was my position until quite recently. Now I'm not quite as sure — but neither am I convinced. I'm fence-sitting here.

People living near a base-station will be exposed to these lower-levels 24 hours a day, and, as the number of cellphone companies increase, the amount of overall daily exposure rises regularly. TV stations and FM radio are also adding to this background smog in roughly the same frequencies.

Simple engineering calculations also fail to take account of different susceptibilities. The DNA in the cells of children are in a constant state of growth, duplication and division, whereas in adults cell division is only an occasional occurrence. That's why differences shows up in diseases incidences like leukemia where children appear to be many times more sensitive to environmental pollutants.

Given the accumulative nature of cancer precursors, it is also possible that some adults are especially susceptible to EMF effects, but this is just conjecture at the present time. Certainly some people claim to feel low level RF exposures as physical warmth or prickling, and before we dismiss these claims too readily we should recognise that some research evidence indicates that there are these biological perceptual differences.

Social issues

And then there are also the social issues to do with individual rights. Handset users are benefiting from cellphones and are making a personal choice. However those families living near towers often get no benefits themselves, and in fact, suffer visual pollution and a possible loss in land values.

So their complaints are understandable. I wouldn't want one of these things in my own backyard either — and if they tried to build one next to my local school, I'd be out marching.

When comparing handsets and towers for potential adverse health effects, electronics engineers like to look at wavelength and resonance calculations. They tend to see biology in simple electro-mechanical terms, and generally believe that the potential for biological effects will be proportional to the amount of energy absorbed by the body. It appears obvious to them that adverse effects can only arise from a dose-related response. This is the basis for all exposure standards.

If body tissue close to a transmitter absorbs twice the energy than a body further away, then engineers assume, on average, that the potential for biological damage (if they even admit such a possibility exists) must be twice as high.

They therefore tend to treat various parts of the human body as a dipole or quarter-wave antenna, and assume that frequencies matching these bio-electrical circuits will resonate. In engineering theory, resonance-related absorption is the key to all effects in bio-electrical circuits, as it is in antenna systems.

In my early school physics days we referred to this type of resonance effect as 'organ pipe', and in my memory, this is the only type of resonance ever discussed. But bioelectrical researchers now see it as only one factor, and think that other forms of molecular resonance may be involved.

However organ-pipe resonance is certainly the most important when calculating the effect of radio waves on tissue heating, and over the years the standards-setters and industry promoters have tried to sell this idea of 'thermal-only effects' as if it were God-given truth.

Of course you get quite different wavelength-resonance effects in different parts of the body, and with different body-orientations to the incident waves, and when performing these calculations you need to allow for the slower speed of radio through complex resistant (and often dielectric) tissue media.

If body heating was our only concern then clearly research on mice should use wavelengths shorter than those for rats. And in both cases, rodent research should be conducted at frequencies proportionally higher than those humans are worried about.

HANDSET USERS ARE BENEFITING FRO

Yet the cellphone industry regularly condemns any mouse research it doesn't like if it were conducted at non-cellphone frequencies. Because of the need to cut costs, a lot of the research was done with exposure equipment using 2.45GHz microwave oven generators (wavelengths of 12 centimetres) when cellphones operate in the 900MHz range (33 cm).

However these relative dimensions aren't all that wrong for rodents being used as surrogates for humans, if you consider head-widths or body-lengths. And certainly much better than the cellphones themselves.

However if you are looking for molecular effects on DNA, then mouse DNA is much the same size as human DNA, so here you'd need to use roughly the same frequencies.

Research scientists are much more interested in some new forms of resonance that I must admit, I struggle to understand. Molecular biology literature today has long and complicated discussions on nuclear magnetic resonance, electron spin resonance, nuclear quadrupole resonance, cyclotron resonance and stochastic resonance.

This is all part of the search for possible molecular mechanisms which might explain the limited evidence available that really low level EMFs can produce problems.

Resonance theories

When I did my university physics and biology forty years ago, only electron-spin and stochastic resonances were known (I think). And my understanding of quantum physics today is severely limited, so I find it difficult to judge the importance of such work.

The problem is that resonance theories also attract the flim-flam men, the Shirley MacLaines, and the snake oil salesmen. And certainly there are a few way-out believers in the paranormal still working in biomedical research, so sometimes the science and pseudo-science are cleverly blended.

Popular resonance theories often appear aligned with Ancient Egyptian crystal-power and ley lines of energy criss-crossing the world and can easily be discounted, but some in the scientific community also believe in strange and unusual things.

It is therefore often difficult to know, therefore, which reports are based on established evidence using scientific techniques, and which are unsubstantiated pseudo-scientific rubbish.

It is also important that we don't dismiss theories and findings just because the pseudo-scientists have taken them up and exaggerated their relevance. Free-radicals are very real in biological cells despite the way they are over-hyped by eco-nutritionists, and stochastic resonance certainly exists at the threshold of sight and hearing.

When looking at the distinction between handsets and towers, we must also consider that radio signals in the outside environment are not pure and isolated phenomenon. We are deluged constantly by hundreds of EMF signals with different frequencies, powers, changes in energy levels, harmonics and transients.

Handset radiation, however, can probably be treated in isolation, and considered as having no more than a couple of major components. Obviously the most important one is in the 900MHz RF region (with some harmonics and variations due to voice modulation), but there are also some at audio frequencies from the baseband circuits.

With GSM and all time-division radio systems, the strongest component is at 217Hz which is the power-pulse frequency (with harmonics also) from the transmitter being rapidly turned on and off.

Another major difference between handsets and towers is the duration of exposure. People living down-wind from a cellphone tower live in its 'blue smog' 24 hours a day.

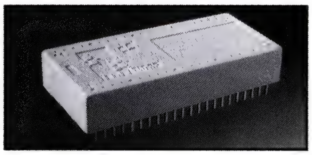
CELLPHONES AND ARE MAKING A PERSONAL CHOICE...

It is not at all clear that low-level constant exposures of this kind are likely to be more benign than spasmodic bursts of higher levels of energy from a handset. So-called 'window effects' appear to exist, where the influences of power and frequencies are non-linear, and sometimes seem to exhibit cyclical variations, which may be related to resonance effects.

We know that some of these window effects (or reverse dose-related effects) certainly exist. For instance, low levels of gamma rays can cause cancer, while high levels are used to kill cancerous cells. It is better to completely disrupt the functions of a cell and cause it to die, rather than create minor modifications to the DNA which might trigger an uncontrolled reproductive phase. ■

THE TIGER COMES TO AUSTRALIA

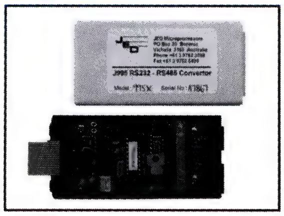
You've seen the BASIC Tiger and Tiny Tiger advertised in the US magazines: they are now available in Australia from JED.



Tigers are modules running true complied (not tokenised), Multitasking BASIC at 20 Mhz, but only draw 45mA. They have memory, 4 x 10-bit analog inputs, digital I/O, two serial ports, RTC, and are superb small controllers for scientific and industrial applications. **A Tiger with 128kB FLASH, 128kB CMOS RAM and RT clock costs only $162.** A development system (W95/98/NT), with a proto board, is only $275. JED has a local board/controller with LCD/Kbd and industrial I/O.

See our www site or call for data sheets.

RS232 to RS485 Converter



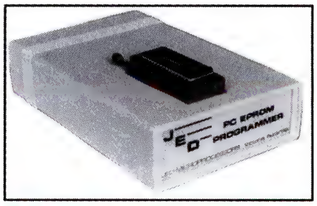
The small plastic case 100mm by 55mm by 25mm is an Australian-built RS232 to RS485 optoisolated converter. It connects a PC or PLC RS232 serial port to a multidrop RS485 differential cable up to 4,000 ft long.

The J995X converter has an internal microprocessor to automatically connect the transmitter to line, so the user program need not use the RTS line for RS485 TX control.

Cost $160 plus $20 plug pack.

$300 PC-PROM Programmer
Also: Chiprase Eraser $225.

This programmer plugs into a PC printer port and reads, writes and edits any 28 - pin or 32 pin PROM without needing special plug-in cards.



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MOFFAT'S **MADHOUSE**

BY TOM MOFFAT

Tom gets sucked in **BIG-TIME!**

DO YOU BELIEVE IN MIRACLES? Electronic miracles at least? There have been a lot of tempting miracles lately. I've just finished reading the Forum column in April EA, a renewed discussion of electronic therapy devices said to cure anything that ails you.

Here we had the brave 'Nurse Cheryl' raising embarrassing questions about the effectiveness or otherwise of 'Rife Machines', allegedly able to cure things like AIDS, hepatitis, and sexually transmitted diseases.

Many people, as a last resort, plunk down big money for gadgets that look suspiciously like Dick Smith surplus items joined together by test leads. But, for them, any hope is better than no hope at all.

My own illness is not so serious, but it still exists: something-for-nothing addiction, and cheapskate-itis. I have a television, and a thin wallet. I live within moderate TV range of three major markets – Seattle Washington, and Vancouver and Victoria in Canada. A cable system is available which combines many of these stations with some cable-only networks, fifty channels in all, for $35 a month. Trouble is, most of the cable channels don't interest me.

Non-cable homeowners usually erect large fringe-area antenna arrays on top of their houses, aimed at the desired city by an electric rotator. But if you're a renter, like me, there's no way you can do that. So that leaves two TV options: cable, or rabbit ears!

I've gone the rabbit ears route for several years, getting up to tweak the set-top antenna with every change of channel. Reception is noisy and ghosty, but watchable (at least for cheapskates). So imagine my joy upon discovering a magazine advert for the Xium Spilateral Antenna, The World's First All-Directional Source for Great TV Reception on EVERY channel.

Rabbit in a can

No multi-element array here. The Xium looked like a two-litre paint can, made of black plastic, with a standard type-F television antenna connector mounted on one end. It could thus be mounted virtually anywhere, indoors or outdoors, and easily taken down again when you moved house.

As the blurb said, "You can mount your Xium in any attic, closet, or other out-of-the-way indoor location. You can mount in on a horizontal mast, closet rod, or suspended from a roof support by one of the included base mount brackets... The Xium Spilateral Antenna is so versatile and may be used inside or outside the home. Simply connect it to your TV, satellite, stereo... and that's it!"

Well, that antenna was going to be the total solution to my TV and FM reception woes, and I could even connect it to my satellite (?). I just had to have one, even though it cost nearly a hundred bucks. It came with a 90-day money-back guarantee, so if it didn't work, I had little to lose other than the shipping charges. The order was placed, and while I was waiting, I did some more reading on the electronic principles involved in the Xium antenna.

"Broadcast signals are sent out from area stations. The Xium Spilateral Antenna collects those broadcast signals with its special patent pending technology. The Xium's unique 'interceptor' circuitry allows those collected signals to resonate energy between each of Xium's multidirectional elements. The 'interceptor' elements join together to form the Xium's electromagnetic energy core for producing higher levels of passive energy for broadcast signals, for adding up to 50% more coverage."

Hey, did you readers get all that? Neither did I. But Xium had included screen photos of a typical TV set. The one using 'Indoor/Outdoor Antenna Gimmicks' had a picture broken up with noise and interference. The photo using the Xium was perfectly clear, a nicely saturated red flower. You could even see water drops on it. What an amazing difference! I was so glad that I'd ordered my Xium.

Two weeks later the miracle antenna arrived, and I realized I had nothing to hook it up with. So off I went to the hardware store to by an eight-metre cable with type-F connectors on each end. These turned out to be on sale for around $3.00, about a third the going rate. I considered it good omen for the success of the Xium.

Xium clearly now?

Time for the test: I rolled out the new RF cable to its full length so it strung clear across my living room and dining room. Then I turned on the telly and selected Seattle Channel 4 which was one of the stronger signals. There was a little noise on it, not bad. Should be noise-free with the Xium, right? Wrong!

I disconnected the rabbit ears and connected the cable from the Xium. What I got on Channel 4 was almost all noise and no picture. So I took the Xium in one hand, and the TV remote control in the other, and started moving around the room. There were places where it peaked a little better than the rabbit ears, but the location was very critical. With the antenna oriented for Channel 4, there was only noisy garbage from Channels 5, 7, 9, and 13 – four more Seattle channels. The Canadian stations were non-existent.

I discovered with the Xium that each TV channel had its own place in the living room where it would work, but then the other channels were useless. I even got Vancouver's Channel 10 to come to life, but as before, the rest were unwatchable.

So it looked like I would have to hire one of the neighbourhood kids to come to my house and stand in the correct place for the channel I wanted to watch, holding the Xium antenna above his head. Changing channels would be a coordinated move between the kid, and my finger on the remote. There must be a better way.

What about an outdoor mount? The first attempt involved setting the Xium on an outside window sill, and that produced three almost-usable channels. The antenna's instructions said "the higher the better" so I borrowed my neighbour's ladder and climbed the wall to about four metres, the highest the ladder would allow.

I held the antenna in position with one screw, and then zipped down the ladder to go inside and gloat over my success. But - the Xium's performance was WORSE!

Then followed many different mounting options, documented by the photographs herein. I found a handy stick of 3x1 wood, attached the Xium to the top, and plugged the other end into the rain gutter's downspout. No difference, in fact a little worse.

Maybe I should follow the instructions more closely. They had suggested 'closet rod' so I plopped the Xium into the coat closet off the living room. Result = Lousy.

More creative options were begging to be tried, among them the stick-it-up-in-a-lamp mount, and the grand finale; the pants-leg-hanging-to-dry-from-the-ceiling mount. This allowed the Xium to experience a 90 degree polarization rotation, but no improvement was evident.

Second chance

Not long after these initial tests, circumstances forced me to move house (I got evicted) so I was able to try the Xium all over again in a whole different setting. This time I was up on the first floor, so I had some altitude between me and terra firma. But alas, the Xium was even worse at this location. At this stage I started to suspect my El-Cheapo RF cable, but substituting another cable made no difference at all.

So what we had here was a $100 antenna that was inferior to my $3 rabbit ears. What was this "Genuine All-Frequency Spilateral Technology", anyhow?

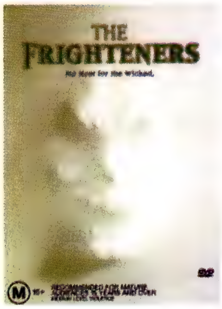
Perhaps there was just a short coil of hookup wire, rolled up, shoved into the can, with one end soldered to the output connector. It seems that would work just as well. It went through my mind to reverse-engineer the Xium - cut it open with a hacksaw to see what is inside. But that would void the 90-day money-back guarantee. And now the antenna is definitely going back where it came from. They might not appreciate a two-part Xium.

Was Tom a silly boy? I don't think so. The Xium was one of those things that just had to be tried. Maybe it would have worked. Maybe it would work just fine in an urban area where there are big fat signals.

It cost me twenty bucks in shipping to find out about the Xium. But that's fine, because I did get a Madhouse column out of it. After all, that's why they call this Moffat's Madhouse! ■

WHAT AN AMAZING DIFFERENCE! I WAS SO GLAD THAT I'D ORDERED MY XIUM.

Ghosts, teenage **monsters** and an interactive fantasy



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THE FRIGHTENERS

Universal, 1996. *Directed by Peter Jackson, with Michael J. Fox, Trini Alvarado, Jeffrey Combs and John Astin. Widescreen; colour, 105m. SS/DL disc, Dolby Digital 5.1; Columbia TriStar Home Video, RRP $34.95.*

■ **I MUST** confess I didn't really notice this one when it went through cinema release, but it turns out to be a kind of *Ghostbusters*-meets-*Psycho* melding of tongue in cheek comedy, horror and thriller – and surprisingly good fun, in a gothic screwball way.

Michael J. Fox is excellent as the conman/poltergeist-eliminator hero, while Trini Alvarado is good as his somewhat reluctant assistant and love interest. Jeffrey Combs is also great as the nazi/nutcase FBI agent, too, and the 'supernatural' special effects are very well done.

The image quality is very good in this DVD transfer, and the 5.1-channel discrete surround sound is also very clean and well balanced (although the movie doesn't offer much in the way of dramatic explosions or other 'showoff' scenes).

There isn't a great deal in terms of bonus extras: just the original trailer and some notes on the production, cast and film-makers. But despite this the movie itself is sufficiently entertaining, and the technical quality of the DVD sufficiently high enough, to make it good value for money. (J.R.)

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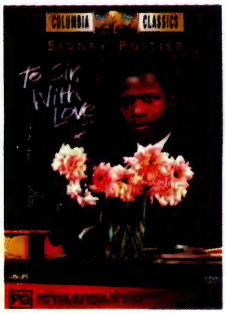

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TO SIR, WITH LOVE

Columbia, 1966. *Directed by James Clavell, with Sidney Poitier, Judy Geeson, 'Lulu', Christian Roberts and Suzy Kendall. Widescreen; colour, 101m. SS/DL disc, Dolby Digital mono. Columbia TriStar Home Video, RRP $34.95.*

■ **IT'S GREAT** that CTHV has been able to release this classic movie on a Region 4 DVD. As you may remember Poitier is superb as the engineer reluctantly working as a teacher, who is really 'thrown in the deep end' at a last-resort secondary school in London's east end. Judy Geeson and Lulu head the class of 'rebellious teenage monsters' that he gradually tames, and as the film progresses we are brought to realise how these troubled kids change 'Sir' just as much as he helps them prepare for survival in the adult world.

Despite the film's age, the image quality on this DVD transfer is in fact excellent – sharp and clean, with very little in the way of distracting artifacts. The mono sound is not quite as good, with a slight edginess that suggests the recording people may have tried too hard in improving the S/N ratio or bandwidth during the transfer. Overall it's quite acceptable, though, and rarely detracts from your enjoyment of the movie.

The bonus extras are pretty modest: just the original trailer and brief notes on Poitier, Geeson and producer/director Clavell. That's not a major drawback, of course, and neither is the slightly edgy sound. The movie is a real classic, and very involving. (J.R)

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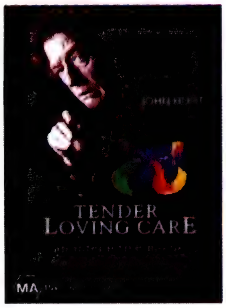

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Bonus Extras:	■■■

TENDER LOVING CARE

Aftermath Media, 1999. *Directed by David Wheeler, with John Hurt, Michael Esposito, Beth Tegarden and Marie Caldare. Widescreen; colour. SS/DL disc, Dolby Digital 2.0; Wild Releasing, RRP $39.95.*

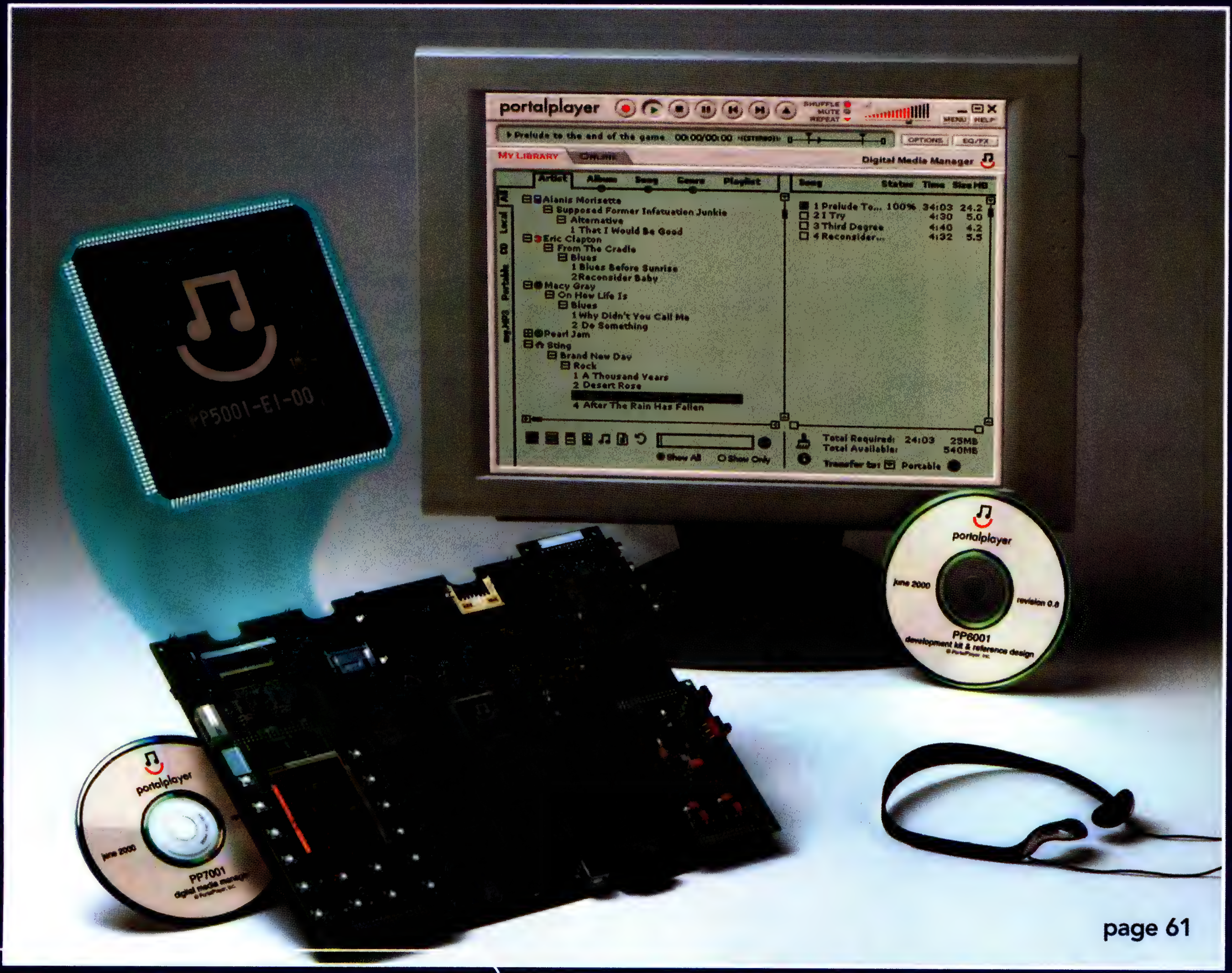
■ **NOT A CONVENTIONAL** movie at all, this one – more a hi-tech mind game; it's billed as an 'interactive full-length movie'. The disc contains multiple versions of scenes and story endings for its psychodrama, and which version you get depends on your answers to on-screen multiple choice 'thematic apperception tests' (TATs) which are shown after each short sequence. It's supposed to involve you in the story, explore your personality and give you 'the fantasy you really want'. John Hurt is host/shrink Dr Turner, who gives you an initial introduction and 'seeks your opinion' from time to time.

The acting of the other players is a bit unconvincing, though, and there's a few image coding artifacts at some of the scene changes. The TATs are also a bit intrusive, which I found made it hard to get involved.

The image quality is very good, and the sound is fine too. Along with the TATs you also get options to 'explore' the house in which the drama is played, and make 'reality checks' from time to time. There's also an accompanying 16-page 'manual'.

An interesting and innovative disc, which should appeal to adventure fantasy and mind game enthusiasts despite its shortcomings. Don't expect to watch it in just a couple of hours, though. (J.R.)

Professional *electronics*



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SILICON **VALLEY**

NEWS

IN BRIEF

■ Japan's top four DVD producers have announced that they are planning to sharply increase production in the face of continued rising demand for DVD players, which will result in an estimated 15 million units sold this year.

The four – Sony, Toshiba, Matsushita and Pioneer – are aiming to increase their combined market share to around 90 percent.

■ Coca-Cola has announced plans to spend US$100 million retrofitting 500,000 vending machines with credit/debit card scanners and thermometers that will allow the machines to charge higher prices for a can of Coke on hot days.

Software will hook the machines up to the Internet. Consumers will be able to browse the Internet and use audio and video to communicate with the vending machines.

■ Intel has dicovered a serious flaw in its PC motherboards and will recall up to a million computers using them. The recall program could cost Intel hundreds of millions of dollars. On Wall Street the news caused Intel's stock to sink by US$11 a share.

Intel said the flaw causes systems to crash easily, and was the result of a defective memory translator hub (MTH) IC that translates signals from SDRAM memory to the Intel 820 chipset.

While Intel said it doesn't know how many machines are affected, it promised to repair them, regardless of the number involved. Intel has made a test program available on its Web site (**www.intel.com**).

Fujitsu & AMD boost flash partnership

FUJITSU AND ADVANCED Micro Devices have expanded their long-time flash memory chip alliance by announcing they will spend US$2 billion on new flash IC fabs, including a new $1.3 billion facility in Fukushima in northern Japan. The latter fab adds to the two other flash production fabs they already co-own and operate.

The announcement came just one day after Intel said it would also spend $2 billion to increase flash memory production in the face of booming global demand.

The AMD-Fujitsu fab could produce as many as 13 million flash memory chips per month by March 2002. Initially most of the chips will have a 16-megabit capacity using a 0.23-micron manufacturing process. That will be improved to 0.18 micron and smaller by 2002. Plans call for boosting the output to 52 million chips per month by March 2003.

Demand for the flash memories is outstripping supply. "We predict that the worldwide flash memory chip market will grow by 91% this year to about US$8.42 billion", said Fujitsu executive Hirofumi Takeda.

The two companies will split the cost of the new fab 50/50, or $655 million each. The two firms will invest another $650 million to triple the flash memory production at a fab in Oregon. The plant's current output is around 10,000 200mm wafers per month. That will increase to 30,000 wafers a month by 2003.

Sales of flash memory chips are expected to rise to about US$15 billion in 2002, up from about $8 billion in 2000, according to researcher Dataquest.

Intel closes gap with AMD

INTEL HAS LAUNCHED a new 933MHz version of its Pentium III processor, a chip that will cost US$744 in quantities of more than 1000 units. The company also announced plans for a new US$2 billion 12-inch (300mm) fab in New Mexico.

The new Pentium chip will allow Intel to compete more effectively with Advanced Micro Devices, which has been selling 900, 950, and 1000MHz versions of its Athlon line of high-end PC processors since March. 1GHz Athlon-based PCs are now commonly available in US computer retail stores. Intel's top-of-the-line PCs currently run at speeds of 866MHz.

Intel, which misjudged PC demand, has been caught struggling to catch up with AMD in the PC performance race as well as bringing new high-end chips to market.

Intel also announced plans to spend $2 billion to boost microprocessor production at its Rio Rancho New Mexico plant, which will also be used to produce the company's forthcoming Itanium 64-bit processor. "This is in support of the healthy growth of the industry", said Michael Splinter, head of Intel's technology and manufacturing group.

The factory will use 300mm wafers and start with a 0.13-micron production process. The new fab will employ 500 to 1000 workers. Already 5200 people work at the Rio Rancho fab campus.

The facility will have 135,000 square-feet of clean-room space and one million square-feet of building space. It is planned to be running at volume production in the second half of 2002.

Gates outlines 'next generation' platform

MICROSOFT CHIEF Bill Gates told a gathering of 160 top industry executives in May that Microsoft plans to unveil a 'Next Generation Windows Services' (NGWS) long-term strategy aimed at developing new software and standards for a broad range of future products.

The NGWS initiative will include technology for smart cards that can be used to identify individuals and give them access to sites and information on the Internet, as well as new programming standards that would allow information to be delivered to different devices without having to reprogram them.

"Part of this is to move beyond the individual PC and to all user devices, whether it's a device in a car, or the TV in the living room, or the PC in its multiple form factors out there. That's a very challenging software problem and even with our $4 billion in R&D, it will take many years to achieve" Gates said, at the start of Microsoft's fourth annual CEO summit at its headquarters in Redmond, Washington.

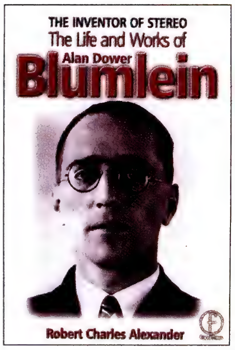
The 160 attendees were all chief executives of companies representing 37 industries. Among them were Walt Disney Chairman Michael Eisner, eBay CEO Meg Whitman and WorldCom CEO Bernard Ebbers. The executives spent two days in seminars and speeches at Microsoft, and attended a private dinner at Gates' US$60 million mansion on the shores of Lake Washington.

One seminar was presented by legendary Wall Street tycoon Warren Buffett. "Next to the World Economic Forum in Davos, this is the best event a CEO can go to", said Carol Bartz, chairman and chief executive of design software maker Autodesk.

The NGWS program also includes developing technology to deliver software products, upgrades and technical support directly into a user's computer over a phone line, rather than having it installed separately. "That degree of user satisfaction and simplicity will be another thing we'll be able to advance pretty dramatically", Gates said. ■

An unsung Genius, and a **clear look** at video compression

LOST GENIUS



THE LIFE AND WORKS OF ALAN DOWER BLUMLEIN, by Robert Charles Alexander. Published by Focal Press, 1999. Hard covers, 242 x 163mm, 421 pages. ISBN 0-240-51577-3. RRP $92.95.

■ I've always been in awe of the enormous impact that Alan Blumlein's research work has had on the worldwide development of electronics, especially when you consider that he was only 38 when a plane accident cut both his career and life short in 1942.

During that very short career he produced some 128 patented discoveries, many of them quite crucial to fields as diverse as stereo audio recording and reproduction, electronic TV and scanning radar. What might the man have achieved if only he'd lived and worked for another 20, 30 or 40 years!

All of which makes it even sadder that few of the younger people in today's electronics industries have even *heard* of this retiring but incredibly brilliant engineer.

Perhaps it would have been different if he'd have been an American, instead of a Brit; or he hadn't been killed on a secret wartime flight, testing radar equipment; or if most of his papers and records hadn't been snaffled by a secretive biographer, who held on to them tightly for decades before himself dying – and still without producing the promised biography.

Still, British engineer and magazine editor Robert Alexander has now made a sterling effort to bring Blumlein's fascinating life and achievements to light, in this solid and informative book.

Amazingly he still couldn't get access to any of the papers held in the deceased biographer's estate, but was able to unearth a lot of information both from Blumlein's patents and the archives of EMI, where Blumlein did a lot of his work. He also apparently talked to and gleaned reminiscences from some of the remaining people who knew and worked with Mr Blumlein – such as famous astronomer Sir Bernard Lovell, who wrote the book's Foreword.

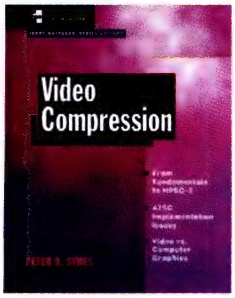
It's ended up a highly detailed and rather technical work, a little heavy going in places but on the whole a great effort considering the difficulties Alexander must have encountered.

So if you'd like to get a much better idea of at least some of Blumlein's amazing achievements, and why he's regarded by many of us as the great 'unsung genius' of electronics, this one's a must.

The review copy came from Butterworth-Heinemann, PO Box 146, Port Melbourne 3207. (J.R.)

* * *

PRIMER ON JPEG, MPEG



VIDEO COMPRESSION, by Peter D. Symes. Published by McGraw-Hill, 1998. Hard covers, 243 x 190mm, 323 pages. ISBN 0-07-063344-4. RRP $126.95 plus GST.

■ The subtitle of this book is 'Fundamental Compression Techniques and an Overview of the JPEG and MPEG Compression Systems', which in itself gives a fairly clear idea of what it's about.

Author Symes is an experienced video and TV engineer who was Manager for Advanced Technology at the Grass Valley Products division of Tektronix, and wrote the book for fellow video engineers or indeed anyone with a reasonably sound knowledge of conventional analog video, who wants to gain an understanding of the digital domain.

There are 12 chapters in all, starting with a look at basic compression concepts and image parameters and then progressing logically through entropy and predictive coding principles, transforms and quantisation. Then the specifics of JPEG are introduced, followed by motion compensation and then MPEG-1 and MPEG-2 in turn. Finally to round things off there's a chapter looking at audio compression, and a 'Closing Thoughts' chapter discussing the DV compression system, SX compression, sub-band compression, mezzanine compression and newer systems such as wavelet and fractal compression.

It's all carefully and clearly covered, with plenty of diagrams and other illustrations, and only enough maths to make the concepts clearer. This should indeed make it a good choice for almost anyone who wants a clearer basic understanding of video compression technology – and how it makes possible movies on a DVD and the soon-to-arrive digital TV.

The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.)

Advanced Electronics for Highly Dependable Automotive Systems

With microprocessors playing a key role in the advancement of automotive electronics, manufacturers are now developing very sophisticated hardware, software and communications systems to expand its contribution. In this article, Ross Bannatyne brings us up to date with how the latest electronics is making cars safer and more reliable.

by Ross Bannatyne

(Advanced Vehicle Systems Division, Motorola)

THERE ARE an increasing number of systems for various applications that require highly dependable operation, often in safety critical applications. One of the latest areas to experience significant growth in this requirement is the automobile. As electronics continues to become a more important part of the design of a new vehicle, systems are performing many more functions under the control of microprocessors and consequently mechanical and hydraulic systems are being replaced by 'by-wire' configurations of sensors, microprocessors and actuators.

Fig.1 illustrates a roadmap which highlights the main electronically controlled functions for a vehicle chassis, and highlights how they are being amalgamated under electronic controls. The goal is to achieve the 'automated highway' – vehicles which will autonomously drive in infrastructures which support higher traffic throughput with fewer accidents.

Four systems are shown on the left hand side of the roadmap – Braking, Steering, Suspension and Collision warning. These systems are being integrated together through serial communications links so that they can share data. This shared data allows more powerful algorithms, which coordinate the functions to be implemented. The integrated systems enhance safety by using more information to optimise system operation. For example, if an object is detected which could be hazardous to the vehicle, the brakes could be applied automatically.

Culminating around 1999, several 'enabling' technologies were pursued aggressively in order to facilitate the fully integrated chassis control systems. These technologies are failsafe or fault-tolerant implementations (which this article discusses), semiconductors

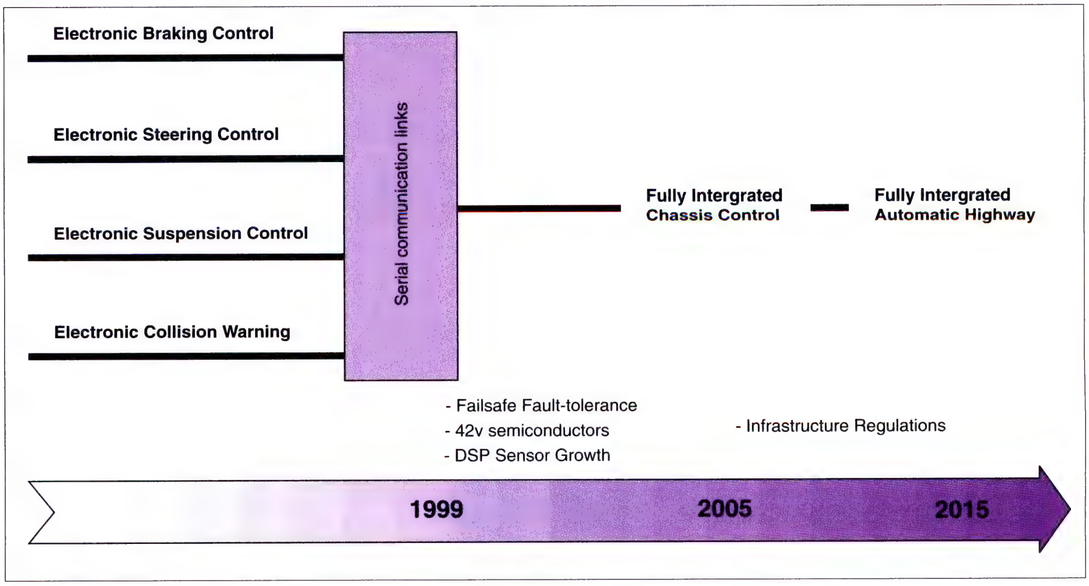

Electronic Braking Control
Electronic Steering Control
Electronic Suspension Control
Electronic Collision Warning
Serial communication links
Fully Intergrated Chassis Control
Fully Intergrated Automatic Highway
- Failsafe Fault-tolerance
- 42v semiconductors
- DSP Sensor Growth
- Infrastructure Regulations
1999
2005
2015

Figure 1 *- Development of Dependable Systems for Automobile Chassis Control* capable of handling the 42 volt requirements which are expected of future automotive electrical systems, low-cost high-performance DSP (Digital Signal Processing) units, and a widespread use of sensors. The availability of these technologies for use in the automotive environment will lead to the availability of such integrated chassis control systems by around 2005.

Further out in the future, many automotive firms and government organisations (around the world) are pursuing the goal of a fully integrated automated highway system. This type of system will rely on an infrastructure and standards which will allow autonomous vehicle behaviour – the car will maintain its own safe driving distance behind other vehicles and will be unable to make dangerous lane changes. The motivation behind such systems is both safety and to increase the traffic throughput on increasingly congested highways. Some estimates indicate that certain countries will have a limited infrastructure available by 2015.

Redundant CPU Configurations

Each of these types of systems require failsafe operation. Traditionally, this function has been facilitated using two microprocessors. There are two common configurations – when two identical microprocessors are used, the configuration is known as symmetric redundancy, and when a smaller less powerful 'watchdog' microprocessor is used, the configuration is known as asymmetric redundancy. These configurations are shown in Fig.2.

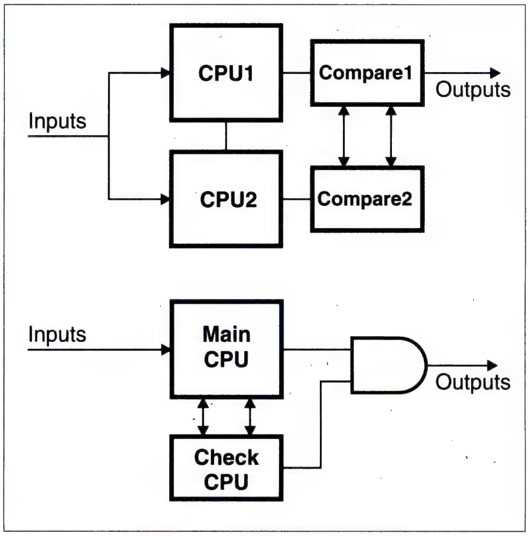


Figure 2 *- Redundant Microprocessor Configurations*

Although each configuration has its own advantages and disadvantages, the symmetric approach is becoming more popular, particularly when both of the Central Processing Units (CPUs) are integrated onto a monolithic silicon chip. The symmetric single-chip solution is popular on account of reduced physical size and the increased reliability that results from reduced number of system interconnections. There is also better electromagnetic compatibility performance, which results from having fewer high-speed signals connected to the outside world. Another benefit of having fewer communications links between several chips is the difficulty in synchronising the operations of the two CPUs.

An advantage of using two separate microcontrollers (rather than two CPUs on a single die) is that there is more choice to select from the many different off the shelf devices available. It is also possible to introduce redundancy into the software by using two different routines.

Analysis of the respective reliability equations for each type of system illustrates that the asymmetric approach can only begin to achieve the same level as the symmetric approach if the total fault coverage accomplished by the 'watchdog' CPU is unity. This is quite a significant factor in favour of using a symmetric approach.

These considerations on the implementation of redundant systems have led to the popularity of using a symmetrically redundant approach in many cases. Examples of such products with two CPUs could be used in failsafe systems.

There is an important difference between fail-safe systems and fault-tolerant systems. Today's Antilock Braking Systems (ABS) are fail-safe: if an electrical system error is detected, the ECU switches to a safe 'off' mode, allowing the foundation hydraulic brakes to operate without the faulty ABS system interfering.

A fault-tolerant system must not only recognise that an electrical fault has occurred, but must continue to operate safely with the existing known fault. Antilock braking systems use redundancy to facilitate a fail-safe system. Typically the CPU at the heart of the system supervises the continual testing of all the major system components. The CPU can only validate these components however, if the CPU itself is known to be 'sane'. Hence a second, redundant CPU is used to validate the sanity of the first CPU.

A redundant CPU can either be implemented as a second standalone microcontroller or as an error detection CPU with comparison logic on the same microcontroller chip. This type of dual CPU configuration is shown in Fig.3. If the two CPUs disagree over result of an instruction execution, the 'fault' signal will be enabled and an interrupt will initiate a sequence of events to switch the control unit into the safe 'off' mode. Dual CPU microcontrollers will increase their popularity in automotive safety critical applications such as steering and airbags, as well as ABS.

Both CPUs are fed with the same inputs, although only one of them (Main CPU) is used to control the chip functions. The Complementary CPU is used only as a check to ensure that the output is exactly the same as the Main CPU. In the event that a fault is detected, an interrupt can be generated which will indicate that the system should deploy its 'failsafe' state of operation.

Memory Validation Techniques

There are other on-chip systems which may be required to satisfy dependability requirements; one might be the ability to verify the contents of on-chip memory. This may be a requirement if a dual CPU is system is used with only one memory array. Therefore something is needed to provide a check on the memory contents. There is a possibility that a memory bit may be flipped (it is after all, impossible to discount the possibility of an alpha particle hitting a memory cell and flipping a bit...).

Until we helped mum cope, the kids were left to help themselves.

Every day, more kids are learning how to survive on their own. Please help us to help them when the Salvos call on you.

Thank God for the Salvos.

THE SALVATION ARMY

SAL 7163

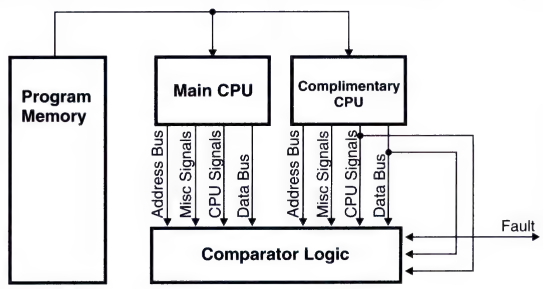


Figure 3 *- Possible Dual CPU Configuration*

The configuration illustrated in Fig.4 illustrates a module which is connected to the internal bus structure of the device. The module will look for free cycles on the address and data buses, and when the bus is not in use, a word will be fetched from memory. This word will be fed into a signature analyser. The process repeats until the entire memory contents have been fetched sequentially and a signature representing the memory contents has been generated.

This signature is then compared to a previously generated value which is representative of the known correct memory contents. On CISC (Complex Instruction Set Computing) microprocessors, there are usually lots of free cycles (often at least one every five cycles). On RISC (Reduced Instruction Set Computing) based microprocessors, there are fewer free cycles, although it is possible to set the memory validation up such that it will 'steal' a cycle if no free cycle is available. This allows deterministic validation time. If the signature matches, there is no need to generate any interrupts so the validation process is basically invisible and will be performed whilst the CPU is executing a control algorithm at full speed.

One shortfall of the memory validation approach is that it becomes very difficult to use this approach on the contents of RAM, which change often. Unless the CPU can stop executing the control algorithm for a RAM check exercise (very unlikely in highly dependable real time embedded control systems), another method is required to ensure dependability of this array. There are two obvious approaches which can both be employed. The first is to add a redundant RAM array. This can be expensive though, as RAM requirements may be large.

The other approach is to add a parity scheme to the RAM such that each byte of RAM has an associated parity bit. A parity RAM generator is required to add these bits when the data is written to memory. When the data is fetched from memory, a parity checker is required to decode the parity and ensure that the data which is retrieved is the same as that which was written. Unless the RAM array is very small, the parity scheme is likely to be more inexpensive that using a redundant RAM array.

In addition to these schemes for validating that the CPU and memory arrays are operating correctly, there are several features that are common on most families of microprocessors for fault detection. Bus Errors are usually generated if a non-implemented or reserved address is specified. Clock monitors are used to detect slow or irregular system clocks, and illegal opcode traps are useful to flagging faults that may occur in memory, software faults and dynamic or static bus faults.

HIGHLY DEPENDABLE SERIAL COMMUNICATIONS

Future automotive systems will continue to see significant growth in multiplexed serial communications. One difference will be that the number and type of multiplexed network in the vehicle will increase. Unfortunately, a single communications protocol that can cost-effectively address every automotive application does not exist.

Instead a number of different communications subsystems will be integrated together in a modern vehicle. Highly dependable 'time-triggered' communication networks will be implemented to handle applications such as Steer / Brake / Drive by-wire, and very robust event-triggered communications networks will be used for multi-bag supplemental restraint systems.

The high dependability of time-triggered serial communications networks for vehicles is achieved by providing a redundant serial link, so that all signals are broadcast with a back-up. Apart from the redundant link however, there are other good reasons why a different approach to serial communications is required in these vehicle systems: existing event-triggered systems do not specify a precise moment in time when a message will be received. A communications protocol can only be predictable if worst case transmission time is known at the time of the design and meet the requirements of the application.

Time triggered and event triggered systems operate very differently. For a time triggered system, control signals are derived from the progression of time, whereas in event triggered systems, control signals are derived from the occurrence of an event (ie. an interrupt).

There are several further requirements for highly dependable real-time communications systems. A small protocol latency is usually required. This is the interval between the start of a message transmission and the message being delivered at the receiver. Minimal latency jitter is also desirable. Jitter is the variability in the message transmission time (ie. maximum message transmission time minus the minimum message transmission time). In the event that several nodes are connected to a system, it is also advantageous to ensure that a message will arrive at all the receiving nodes at the same instant in time.

In summary, time triggered communication offers high predicability and easier testing for timeliness but it is inflexible in that additional nodes cannot be added to the system after it has been defined without prior knowledge. Event triggered communication systems are much more flexible with regard to adding nodes but are more unpredictable and require thorough testing to ensure that an overload condition does not occur when many events occur and the bus bandwidth is assaulted. ■

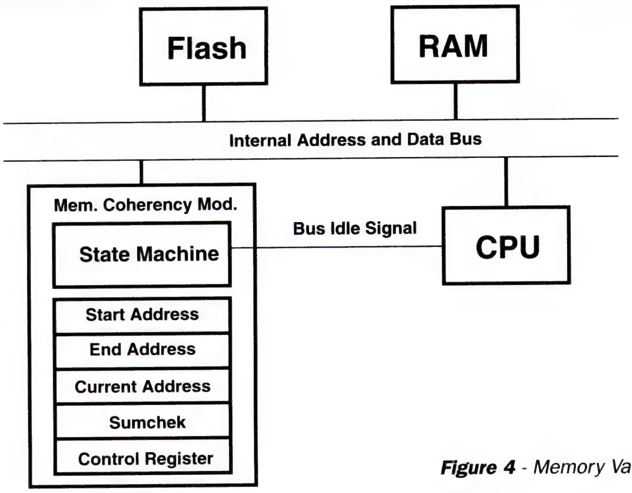


Figure 4 *- Memory Validation Module*

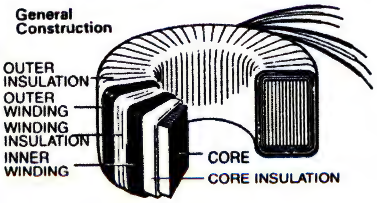
Conclusion

This article has discussed several of the key areas where microcontrollers are being enhanced to be better suited to applications which require a high degree of dependability or the ability to diagnose faulty operation. Until only recently, such functionality was almost always implemented at the system level, as there has been limited availability of semiconductor devices with appropriate functionality.

The number of applications that require such capabilities is increasing significantly. The automotive marketplace is only one example in the growth of highly dependable system operation, but has been influential in driving progress through its high volume appeal.

The low cost requirements in this market has also helped lead semiconductor vendors to implement such on-chip systems as efficiently as possible. The same approach can be reused in other application areas that require the flexibility and performance of an 'off-the-shelf' popular microcontroller family, but with specific features added to ensure high dependability. ■

TOROIDAL TRANSFORMERS



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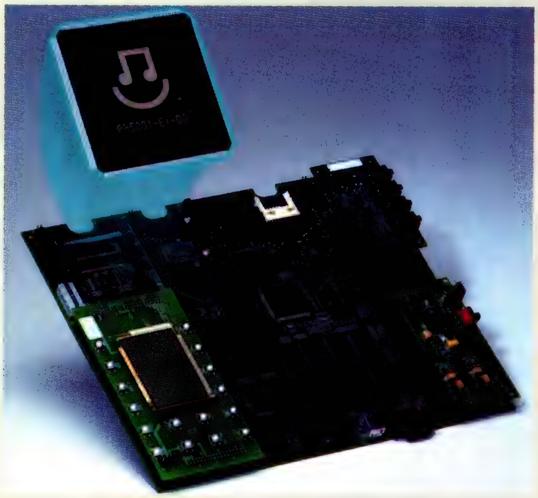
TANGO TO YOUR MP3

PORTALPLAYER HAS INTRODUCED the Tango digital media platform, a complete system for new consumer electronics products with digital audio downloading, recording and playback capability. The new platform, targeted at next generation designs of portable MP3-type player/recorder systems, hybrid systems combining CD and digital audio players and recorders, and hard-drive equipped digital audio jukeboxes, is the industry's first single-chip solution supporting direct recording of CD content in MP3 file formats.

The Tango digital media platform includes the PP5001 Super integration system-on-a-chip controller, the PP7001 Digital Media Manager application for Windows PCs; and all necessary firmware to implement mass-market products, including licensed applications and the Real-Time Operating System (RTOS).

PortalPlayer also provides a development kit and reference design (PP6001) to produce systems fully compliant with standards defined by the Secure Digital Music Initiative (SDMI).

"Consumer electronics OEMs recognise that adding digital content recording and playback capability is a killer application, not just in new portable devices, but for the mass market audio products that make up a huge part of their business," said Gordon Campbell, chairman of the board of PortalPlayer. "Our goal is to make it as easy as possible for these manufacturers to produce great products."



Platform for Differentiation

The Tango digital media platform supports a broader range of licensed and ported applications and memory/media types than any other currently available solution. It includes an extensive suite of decoders, encoders, digital rights management technologies, encryption standards, audio effects, and both solid-state and disk-based storage.

With the Tango digital media platform, a consumer electronics OEM can focus its resources on brand-level product differentiation, while PortalPlayer provides a strong hardware and software base to build on. Since standards and technologies are very fluid, particularly related to security and digital rights management, the platform is designed to be upgradable via downloads of new firmware. This allows both feature enhancements and security system modifications, preventing the end user's purchase from quickly becoming outdated.

"We think that the enthusiasm surrounding MP3 and other digital compression formats in the personal computer and portable device markets validates the enormous market potential of digital content distribution," said John Mallard, president and CEO of PortalPlayer. "As OEMs build support for these digital formats into traditional audio products, such as car stereo and mini-component systems, and new types of hybrid devices, market volumes will quickly reach tens and hundreds of millions of new systems annually."

Highly Integrated System

Based on PortalPlayer's Super Integration Chip Architecture, the PP5001 Controller integrates an ARM7 TDMI host processor, a co-processor for hardware accelerated encoding, and comprehensive external interfaces to peripherals and storage. PortalPlayer customers can define the precise firmware implementation of the Tango platform to produce a tailored product with the codecs, security and memory configuration desired to meet specific end-product price and feature requirements.

The Tango platform is the first low-power, single-

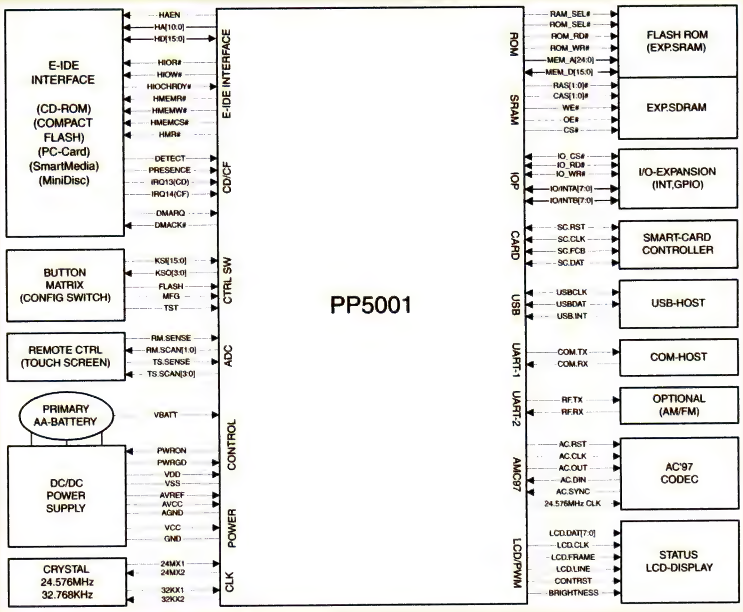
TANGO PP5001 OVERVIEW

ARM7 TDMI based core.
Co-processor enables real time encoding acceleration.
Supports SDMI Portable Device Specification 1.0 Phase 1, flash upgradable to Phase 2.
Complete firmware suite supports record/playback from various sources, user navigation of audio files, tone control and a variety of system control functions.

Audio Encoder/Decoder
MP3, Advanced Audio Codec (AAC), Microsoft Windows Media Audio, QDesign and decoding on the player.
Supports MP3 audio encoding for direct CD recording on the player.
Variable bit rate sampling from 2K to 256K bits per second.
Supports 2KHz to 96KHz decoding sampling rates.
Data encrypted/decrypted using 128-bit Safer128, Elliptic Curve (ECC) and hashing algorithms. Also supports specific algorithms from Mjuice.

Storage
Integrated SDRAM controller supports up to two banks of up to 128MB SDRAM per bank.
Flash interface supports up to two banks of up to 128MB Flash per bank.
Supports Sony Memory Stick; SD (Secure Digital) Memory; MultiMediaCard; SmartMedia cards.
External Compact Flash (CF) interface addresses all available module sizes.
Enhanced MicroDrive interface to support the latest generation of high capacity rotating media storage.
Integrated 32KB SRAM and 8KB of cache.
Programmable access time for ROM/SRAM/SDRAM/FLASH memory.

LCD Controller
Direct interface to single scan LCD panels.
Support for 1, 2 and 4-bits per pixel, with 16 greyscale dithering engine.
Supports panel widths up to 1024 pixels



chip solution to support MP3 audio encoding for direct recording of CD content without a PC, making it ideal for personal stereos and other compact system designs. It also supports multiple decoding formats for playback, enabling manufacturers to produce single systems that can handle content in all popular and many emerging formats, and provides consumers with a much broader range of content compared to currently available devices.

To date, PortalPlayer has announced support for MP3, Advanced Audio Codec (AAC), Microsoft Windows Media Audio, and QDesign decoder technology. Voice codecs with increased compression ratios for spoken word content, and additional codecs for recorded music, will be made available in the future through flash programmable upgrades and PC application plug-ins.

PortalPlayer also implements multiple levels of security and Digital Rights Management in the system firmware. The Tango platform is compliant with SDMI Portable Device Specification 1.0, Phase 1, including Verance Corporation's SDMI Phase 1 Watermarking System. Announced support for Digital Rights Management (DRM) systems includes the InterTrust MetaTrust Utility, DOWNLOADSdirect by Mjuice, and Microsoft Windows Media Rights Manager.

Comprehensive Feature Set

OEMs also have the flexibility to design-in any current standard or new storage media format for consumer electronics systems. The PP5001 controller directly supports Compact Flash, Sony Memory Stick, SmartMedia, MultiMediaCard, and SD (Secure Digital) Memory solid-state storage. Tango-based systems can support two banks of Flash memory, with up to 128MB per bank, and two banks of SDRAM, with up to 128MB per bank.

Other hardware features of the Tango platform include an ATA-33 IDE controller for direct interface to CD-ROM and computer disk drives, an LCD graphics controller for single-scan, 16-gray scale displays, general purpose I/Os for navigation buttons, and an AC '97 2.1 compliant audio codec interface.

Additional features to optimise the system for portable devices include FM radio preset storage, and a remote control interface for transport, volume, and display of LCD data on a headphone cable.

Optimised PC Software

As part of its commitment to speed time-to-market for its consumer electronics customers, PortalPlayer provides a Digital Media Manager software suite as an integral part of the Tango platform. The PP7001 software is a complete Microsoft Windows 9x compatible application that an OEM can customise with its own user interface, or 'skin', to create a distinctive look and feel.

Designed as a best of breed application, the PP7001 provides 'Virtual Content' management to seamlessly unify local and web content, audio effects, and including reverb and stereo enhancement.

The Tango platform is priced at $40 (1000) per set. It is now sampling to qualified OEM customers, with volume production scheduled later this year.

For more information on contact PortalPlayer at www.portalplayer.com. ■

in 16 pixel increments, and panel heights up to 512 pixels in 8 pixel increments.
LCD Bridge interface provides display address and control interface for controller based small form factor LCD displays.

Power Management
PP5001 provides long battery life using a single 1.5V AA battery.
Advanced power management features support auto system shutdown while idle.
Smart Battery charge level monitoring support.

PC Interface
ATA-33 IDE controller allows direct interface to CD-ROM and hard disk drives. Supports up to two channels with four devices.
OHCI compliant USB 1.0 interface supports data transfer rates up to 12Mbps.
Two RS232 interfaces, with a separate serial bus interface.

Peripheral Interface
16 General purpose I/Os for support of various navigation buttons including Play, FFD, REW, etc. Supports additional general purpose I/Os through external matrix.
AC '97 2.1 audio codec interface supports Stereo CD balanced Line In, Stereo Line In/Out, Mono Mic In, Stereo Headphone Out, SPDIF In/out.
Remote control interface for transport, volume and LCD data on headphone cable.

Miscellaneous
The ARM7 TDMI core provides processing power for next generation decoding/encoding algorithms and complete SDMI support.
FM radio station preset storage capability.
Displays song title, time played and total time of track.
Support for automatic download to portable from PC Digital Media Manager application.
Firmware Media Management enables track deletion, record, playlist selection and equalisation modifications directly on player
Status indicators while recording music directly from a CD and while downloading music files from the PC.
Flashable firmware capability.
208 pin TQFP, 256 BGA package.

PROFESIONAL **PRODUCTS**

Monitor test generator

The GV-241 Test Generator from Promax is an indispensable instrument to verify and repair computer monitors.

THE GV-241 is a universal generator that accommodates the multiplicity of the different graphic systems used in today's marketplace. The signals obtained from the GV-241 are truly reliable in terms of synchronism periods and both line and frame blanking periods, and supports up to 29 possible graphics systems.

The instrument can manage horizontal and vertical scanning periods or frequencies, horizontal and vertical scanning front porch time, horizontal and vertical scanning back porch time, horizontal and vertical synchronisms, polarity of synchronisms and interlace. The user can select each graphics system by using the front panel buttons and easy to read, backlit LCD display.

The GV-241 offers three types of connectors for direct connection to the monitor: the D9 for Hercules, CGA and EGA monitors, the D15 miniature for VGA monitors, and the D15 for Mac II monitors. In addition, there are individual R, G (with manual synchronism select), B, CVS (video without synchronism), VS (vertical synchronism) and CS (composite synchronism) outputs through BNC connectors. The GV-241 allows the user to change the system, the chart and the synchronism polarity easily and conveniently using the push buttons on the front panel.

A total of eight pattern charts are available and can be selected for any of the graphics systems generated. They are: 4 colour bars, white 100%, multiburst, crosshatch and scales of grey. Each pattern enables a particular adjustment or the detection of defects in the various modules of the monitor through simple observation of the resulting picture or the video signal with an oscilloscope.

For more information, contact Emona Instruments on (02) 9519-3933, fax on (02) 95501378 or email testinst@emona.com.au.

* * *

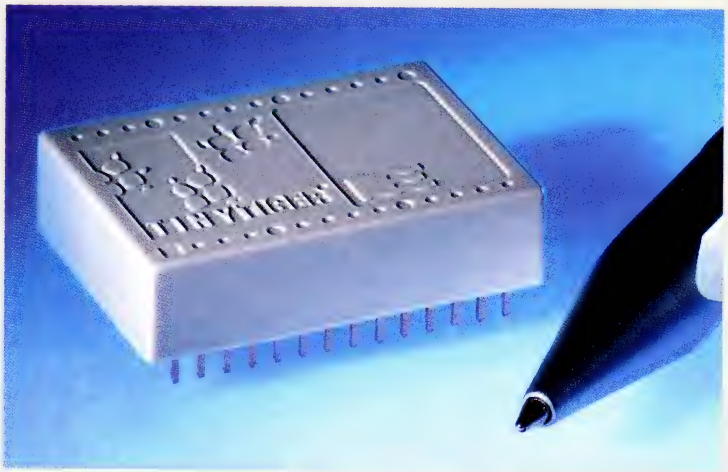
BASIC Tiger Micro Module-E

A NEW ADDITION to Tiger microprocessor family is an economy model, designed to allow for Tiger use in applications where cost or size previously precluded its use.

The device has a high speed 16/32 bit microprocessor, with built-in RAM (32KB/128KB/512KB) and FLASH memory (128KB or 512KB). There are two UARTs and a 4-channel, 10-bit ADC. Digital I/O ports allow direct I/O or external expansion, via a low-EMC peripheral bus structure, to 1,920 bits of I/O, directly controlled under BASIC with IN and bit-masked OUT instructions. SPI and I2C instructions as well as LCD drive and keyboard scan are provided. (If a real-time-clock is needed, a standard Tiny Tiger with RTC is available, or the SPI instructions can communicate with an external clock chip.)

The Module-E (or Economy) Tiger is only 39mm long, 28mm wide and 10.2mm high, and weighs 16g. It has 28 pins (reduced from the 44 pins of the now widely used Tiny Tiger). The Module-E has 28 of the same 0.025" square gold pins on 0.1" centres as the Tiny Tiger, in rows 0.9" apart. An adapter is available to allow the Module-E to plug into BASIC or Tiny-Tiger prototype boards.

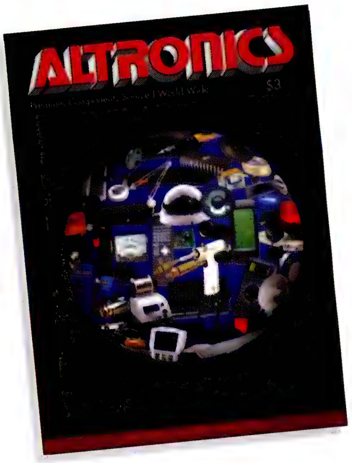
The development environment for the Module-E Tiger is exactly the same as for the Tiny Tiger – a Windows or NT based compiler on a PC edits, compiles and links the code written in powerful 32task, multitasking BASIC. The resultant machine code file is downloaded to FLASH memory inside the Module-E via a serial port at high speed. The code can then be debugged remotely with break points, single stepping and 'data watching' all operating via the serial cable. No in-circuit emulator or other debug hardware is needed. Users only need an RS232 buffer in their target system from one of the two serial ports, and a link or switch to enter 'download' mode.



JED supports the whole Tiger range in Australia with local boards, development systems, applications help and custom system design services. Contact JED at:

JED Microprocessors Pty Ltd, 172 Boronia Rd, Boronia, Vic., 3155. Phone (03) 9762 3588, fax (03) 9762 5499, or examine BASIC Tiger data on www.jed-micro.com.au

ALTRONICS



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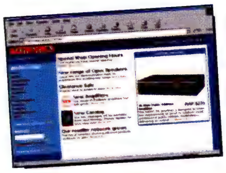

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Please Note: EA (Electronics Australia) & Silicon Chip subscribers will automatically receive their catalogue FREE with the respective July editions

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And for the very quick...

To celebrate the release of our finest ever catalogue and new internet website, we are offering these excellent products at GST inclusive bargain prices!

23 Range Multimeter

This compact meter will easily slip into your pocket, it's great for anyone on the move, or alternatively for a students toolkit. Includes an audible continuity buzzer, Transistor Tester, Diode Tester, 'K' type thermocouple, and square wave test output. Measures DCV to 1000V, DC Amps to 10A, ACV to 750V, resistance to 2MΩ and temperature from -40°C to 250°C. All this plus a HOLD function for this tiny price!

Includes temp probe for measurements up to 250°C!

Q 1059 Was $32.95, NOW **$20**

Programmable/Learning Remote Control

Replaces up to ten remotes

Features:

- Stores up to 47 functions per device
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- Equipped with Date, Time and Alarm clock
- Sleep Function
- Low Battery Indicator
- 12 month warranty
- Macro Functions

From this...

...to this!

A 1002 was $129 NOW **$99**

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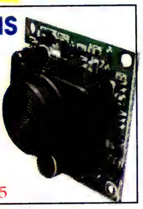
"Excellent for servicing PCB's and identifying micro miniature circuitry"

Identify those impossible to read micro miniature components with our "Inspect-A-Gadget" illuminated magnifier. Uses are not only limited to electronics, of course. It's ideally suited to stamp and coin collectors, model makers, embroiderers, jewellers and the like.

A 0970A Was $129, NOW JUST **$99**

FREE !!! This month buy the Inspect-A- gadget and you will receive a bonus A 0960 Hand Held Illuminated Magnifier valued at $10.45

PCB mount CCD Cameras



Using only a 3 wire connection, these mini cameras can be installed so they are virtually undetectable. Three models to choose from.

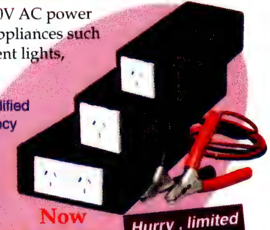
S 9010
S 9011 with Audio
S 9021 Pinhole + Audio

All models were $119, NOW A CRAZY **$69**

All models require regulated supply. (M 9516) $28.95

Mains Power *ANYWHERE ANYTIME!*

These inverters will generate 240V AC power from your car battery! Powers appliances such as televisions, VCR's, incandescent lights, shavers, power tools, etc.



Features: • ±10% regulation, modified square wave output • 90% Efficiency •Thermal and overload protection •Compact and lightweight •Audible Low Battery Alarm & Shutdown •High Surge Capability •Fan cooled

	Was	Now
M 8110 140W Inverter	$145	$99
M 8115 300W Inverter	$239	$149
M 8118 600W Inverter	$389	$249

Hurry , limited stock 50 of each model only at these insane prices!

2-Way Split Speaker System

Transform your car sound into a sensational sound experience with this fantastic Split System. Supplied complete with 2-way crossovers, mounting kit, grilles & speaker wire. Imp.: 4 ohm, Power Rating: 100W RMS, Freq. Resp: 55Hz–20kHz

C 9302 Was $175, NOW **$129**

Gas Soldering Iron

Features : •Equivalent to 50W of power •Up to 1 hours use per fill of butane •Compact, portable and easy to use

This month's RED HOT SPECIAL Buy a T 2595 and receive a can of butane gas and roll of solder absolutely FREE! Valued at $11.50. All up, a total saving of over $18.00. Limited stocks, 50 only at this CRAZY PRICE!

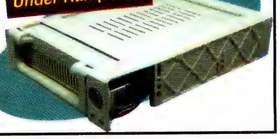
Ideal for those one off small solder jobs away from the work bench. No need to run out a mains extension lead to fire up your normal soldering iron

T 2595 Was $36.50, NOW **$29.95**

SCSI Mobile Hard Drive Bay

Features: **•Power & HDD activity LED display • Fan cooling. Great for 3.5" hard disk drives, ZIPs, LS-120, DATs etc.**

Under Half price !



D 5510 SCSI Was $45 , NOW **$20**

Thunderous Subwoofers

AMAZING TWO FOR ONE OFFER!

Buy one of these fabulous subwoofers and get another one of equivalent value *FREE! That's up to $155 worth of extra value.*

Not only do these sound sensational, they look sexy too!!

The polypropylene cones which are mirror finished will not flex or distort under high power use. They are specially designed for small sealed or vented enclosures.

Ideal for use in a car for a punchy addition to your stereo system.

C 3048 120W 8"	$105
C 3050 150W 10"	$115
C 3055 200W 12"	$155

Premium quality 5mm LEDs. Mixed colours. Pack of 100 $10/pack That's only 10c per LED!

Polypropylene Speakers

Both employ polypropylene cones for minimal flexing and distortion. High specification hi-fi loudspeakers for component systems or replacement speakers.

C 3084 50W 5"	$20ea	or $30pr
C 3086 75W 6.5"	$25ea	or $40pr

Approved Cat 5 cable

From as little as $0.36/m

305m Handy pull box

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Batteries designed for down-hole duty

CUSTOM engineered lithium-thionyl chloride batteries that are designed for high-temperature down-hole oil and gas exploration applications are available from Battery Engineering, Inc. of Canton, Massachusetts, U.S.A.

Battery Engineering Lithium-Thionyl Chloride Batteries are constructed from 304L stainless steel with reinforced hermetic glass-to-metal seals, and are designed for powering down-hole tools. Capable of operating at up to 200°C and withstanding 20,000G shocks, these high voltage, high energy density batteries can be configured to outlast drilling tool bits.

Featuring capacities from 0.08 to 135 A/H with 3.0 to 3.6 volts per cell and 600 Wh/Kg energy density, these batteries can be custom fabricated with multiple cells in annular and cylindrical 'DD' size configurations as long, narrow staves. Long-lasting, they retain up to 80% capacity after 10 years.

Battery Engineering Lithium-Thionyl Chloride Batteries are priced according to configuration and quantity. Literature and price quotations are available upon request.

For more information contact: Battery Engineering, 100 Energy Dr.,Canton, MA 02021 U.S.A.

Email: info@batteryeng.com, Website: www.batteryeng.com.

Bus-based temperature controller

DANAHER CONTROLS has announced the new MLC9000, a bus-based temperature control innovation that interfaces with PLCs or Human Machine Interfaces (HMIs), to integrate temperature control and machine control. The MLC9000 eliminates the need for integrated PID blocks that degrade PLC performance, and multiple single-loop panel-mount controllers that waste panel space and prevent centralised control. It is an integrated solution that works with the PLC or HMI to deliver machine control and high-performance temperature control with a single centralised interface. The MLC9000 will be marketed under the Danaher Controls brand names of: Dynapar, Partlow, and WEST.

Eliminating the PID block removes the burden of analog temperature control from the PLC, delivering single-loop performance levels with a host of advanced features. RaPID fuzzy logic offers quick reaction to process disturbances, maintaining constant precision control. EasyTune offers an adaptive tuning algorithm for auto-tuning the PID loop, eliminating expensive software solutions. Other features include a deterministic 100ms sample time, built-in heater break alarms, the ability to hot-swap single loops, and a building block approach to adding additional loops, eliminating the need to purchase four or eight loops at a time.

For more info, contact Danaher Fulfillment, Next Communications 6520 Edenvale Blvd., Ste. 112 Eden Prairie. MN 55346

Fume exhaust arm

THE ALSIDENT System ESD 50 and ESD 100 series of fume exhaust arms have achieved the unique distinction of gaining certification attesting to their safety for use in electrostatic discharge sensitive (ESD) and explosion sensitive (EEx) applications.

Pyrotek - who distribute both the Alsident and Fumex ranges in Australia and New Zealand - claim that it is the first time any fume extraction equipment of its type has gained certification by an accredited test authority that the electrical conductivity of the system as a whole exceeds relevant standards.

The certification is good news for computer and other electronics manufacturers whose reject rates are lessened by any measure that lowers the risk of electrostatic discharge through PCBs and other sensitive components.

It is equally important for laboratories as well as chemical, pharmaceutical, food and similar industries facing the need to exhaust powders, combustible gases, dust/air mixtures or fumes that pose possible explosion hazards.

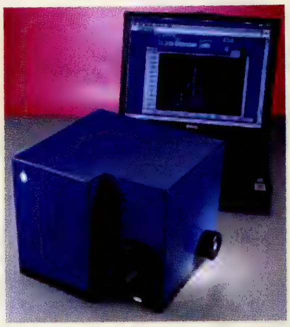
Using the ESD/EEx models of the Alsident Systems 50 and 100 puts an end to the need for such users to keep treating surfaces with expensive chemicals to ensure the fume exhaust equipment remains antistatic.

The Alsident System, in either capacity, is available for mounting on wall, worktable or ceiling. Designed ergonomically for improved productivity, its three joints enable the operator to effortlessly position the mouth spatially anywhere within its reach, which can be up to 1350 mm, and lock any joint at a finger-twist of a knurled knob.

Get more info from Pyrotek, 147 Magowar Road, Girraween 2145; phone (02) 9631 1333.

UV to IR spectroradiometer

INTERNATIONAL LIGHT, introduces the IL2000 SpectroCube Spectroradiometer. It is a new automatic, high resolution, absolute reading spectroradiometer that operates over a wide spectral and dynamic range, with low scatter, and can be controlled remotely from a PC or laptop over a phone line.



It features double pass single grating optics, which provides a scatter figure of I x 10-6 and dispersion of 4nm/mm. Operating from 250 to 1100nm and autoranging over eight decades from 200pW/cm2/nm to 40mW/cm2 (at 500nm), with an f/4 aperture ratio and ±0.5nm wavelength accuracy.

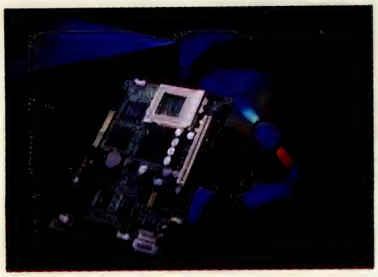
Fully automated, the SpectroCube is powered on/off under remote software control and has a sleep mode for unattended field monitoring. Measuring 225 x 225 x 225mm and weighing 9kg, it can be used in any physical orientation. Standard features include a lock-in amplifier, firmware for optical wavelength self-calibration, and a LabView(r) software user interface.

The IL2000 SpectroCube(tm) Spectroradiometer is priced from $24,995. (U.S.D.) (list). Literature is available upon request. For more information contact International Light, 17 Graf Rd., Newburyport, MA 01950, or visit their website at www.intl-light.com.

• •

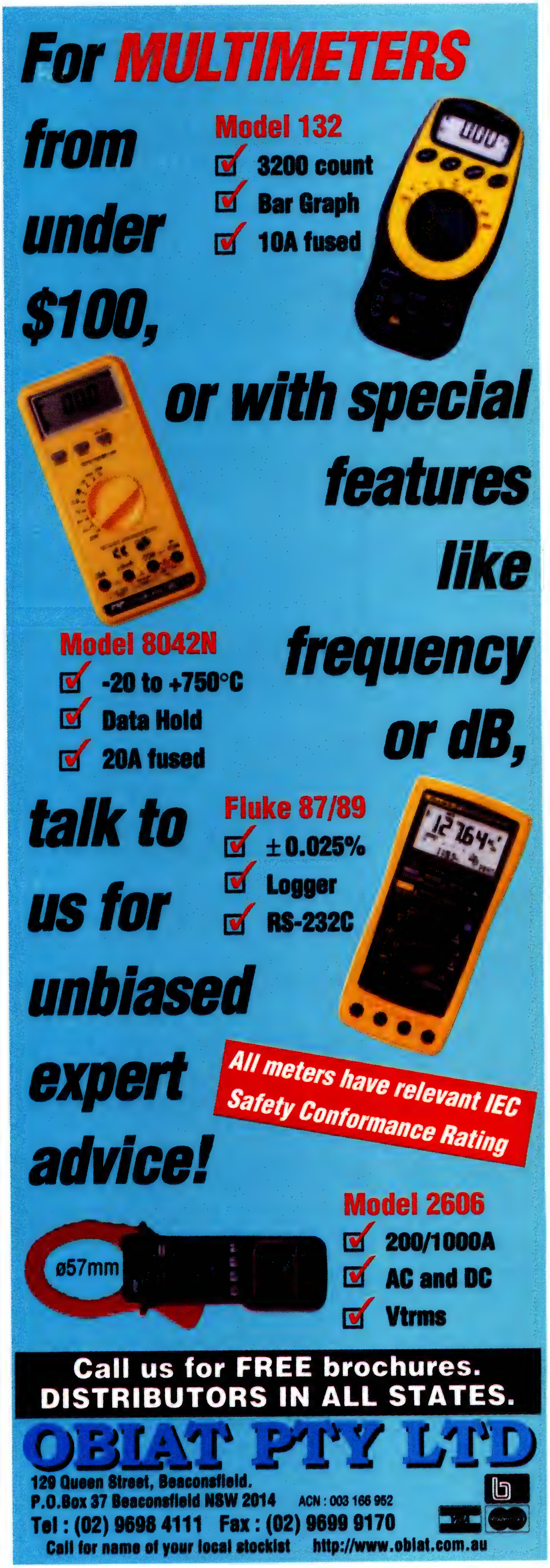
Pentium SBC has superior AV performance

A NEW Advantech SBC, 5.25" single board computer has been released by Priority Electronics. The PCM-9574 supports Pentium III processors plus impressive video and audio capability. This socket 370 SBC offers a Trident Cyber 9525 DVD controller for on-chip 2X AGP 3D VGA/LCD as well as an on-chip hardware-assisted MPEG 2 accelerator.



The ESS 1989 Audio controller with I.I W per channel amplifier supports AC97 3D stereo surround sound with additional support for a MDC connector for optional software modem card. These advanced video and audio controllers in combination with Intel's Pentium III processors up to 866 MHz and higher, can satisfy system designers' most demanding video/graphics application needs.

The PCM-9574's functionality can be used in exciting new ways. For more info, contact Priority Electronics, 189 Bay Road Sandringham, Vic, 3191. Email; sales@pe.com.au Phone: (03) 95210266. ■



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☑ Data Hold
☑ 20A fused

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☑ RS-232C

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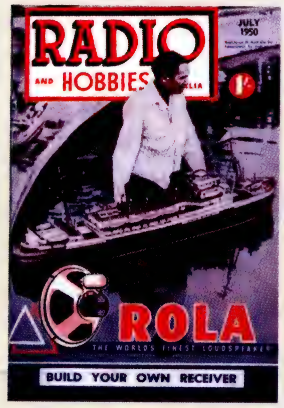
HISTORY & CROSSWORD

Published since 1922, **Electronics Australia** is one of the longest-running technical magazines in the world. Here are some interesting items from past issues:



50 YEARS AGO

Magnetic pickup cartridge: Goldring engineers have succeeded in producing a small magnetic pickup cartridge which will directly replace many flat type crystal cartridges now in use.

Using a replaceable miniature sapphire stylus, it is virtually a needle-armature movement, and the stylus can be changed with the fingers. Stylii are available for either standard 78 rpm or long playing discs, it being assumed that the arm will be suitably counter-weighted when the latter are being played.

Flying saucers: The daily press carried recently what are claimed to be the first actual pictures of a flying saucer, snapped by an American farmer.

While not very conclusive, in themselves, the photographs, together with a report from two local airline pilots, must force one to the conclusion that there is something very tangible behind all the vague rumors and reports.

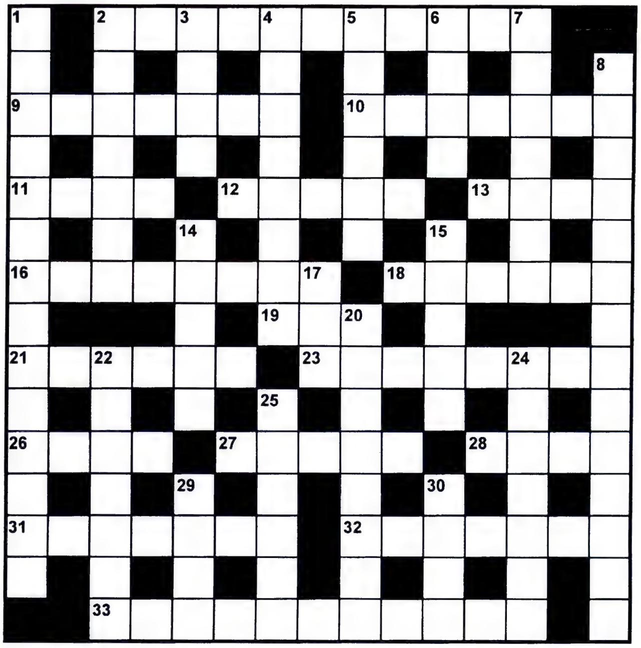
The authorities, whom one would expect to be most concerned, are apparently taking little notice of it all. Either they take a lot of convincing or else someone has gone farther along the road of development than it is politic to admit right now.

25 YEARS AGO

Gloomy future for colour TV makers: Mr Tiki Shigemi, Australian Sales Director of MELCOA-National, manufacturers of the National range of Panacolour TV sets, recently forecast a gloomy future for Australian colour TV manufacturers. Mr Shigemi was commenting following a recent decision by the Australian Government to reduce import tariffs on colour TVs.

"The decision by the Australian Government not to give adequate protection to the Australian colour television manufacturing industry is, bluntly, a shocker," Mr Shigemi said. "The black-and-white TV manufacturing industry in Australia is dying on its feet and this latest decision means that by this time next year, the colour side of the industry will be in the same state."

Canada's domestic satellite system: Telsat Canada recently launched its third and final spacecraft in the Anik series to complete Canada's domestic satellite communications program. Known as Anik III, the new satellite joins two sister spacecraft launched in 1972 and 1973. The Canadian Telsat program has been designed primarily to improve radio, television and telephone links throughout the country, with particular emphasis on the remote northern areas. ■



ACROSS

2 Property of certain alloys able to recover form. (5,6)
9 Reproducing from an original. (7)
10 Basis of certain earphones. (7)
11 Large asteroid. (4)
12 Electrode. (5)
13 A gateless triac. (4)
16 Summed. (8)
18 Lighting control. (6)
19 Type of memory. (3)
21 Checked performance. (6)
23 Having cooperative action. (8)
26 French Nobel prize-winner for magnetism studies. (4)
27 Flow of excess current. (5)
28 Very large scale integration. (1,1,1,1)
31 Communication pathways to satellites. (7)
32 Theorist on minute matter. (7)
33 Shifting of some beats in a metrical pattern. (5-6)

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1 Alloy showing excellent shape recovery. (6-8)
2 Back-up in advice and help. (7)
3 Line at centre of rotation. (4)
4 Professional person with technical skills. (8)
5 Put information in suitable form, (6)
6 Coloured variety of quartz. (4)
7 Metallic element discovered by Gadolin. (7)
8 Powered plunger product using 2 across, (8,6)
14 Name of key. (5)
15 Alarm component. (5)
17 Disk operating system. (3)
20 Instrument recording muscular actions. (8)
22 Insulating substance. (7)
24 Element number 31. (7)
25 Compressed transmissions. (6)
29 Reverse a procedure. (4)
30 Said of iron used in electromagnets. (4)

JUNE SOLUTION

M	E	G	A	H	E	R	T	Z	■	C	U	R	I	E
E	■	A	■	A	■	A	■	E	■	O	■	E	■	N
G	R	I	D	C	O	N	T	R	O	L	■	S	A	E
A	■	N	■	K	■	G	■	O	■	L	■	K	■	R
W	I	F	E	■	N	E	C	■	W	I	R	I	N	G
A	■	U	■	O	■	■	■	R	■	M	■	L	■	Y
T	E	L	E	P	H	O	N	E	C	A	B	L	E	■
T	■	■	■	E	■	O	■	D	■	T	■	■	■	A
■	M	I	C	R	O	P	R	O	C	E	S	S	O	R
E	■	N	■	A	■	S	■	■	■	D	■	E	■	R
C	A	V	I	T	Y	■	C	R	T	■	A	R	I	A
H	■	E	■	I	■	K	■	A	■	C	■	V	■	N
O	C	R	■	O	V	E	R	D	A	M	P	I	N	G
E	■	S	■	N	■	Y	■	I	■	O	■	C	■	E
S	P	E	C	S	■	S	L	O	W	S	P	E	E	D

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86 Experimenting with Electronics
90 Vintage Radio
94 $10 Wonders: Reversing Motor Control
96 Marketplace
98 Webwatch
98 Dilbert

generator

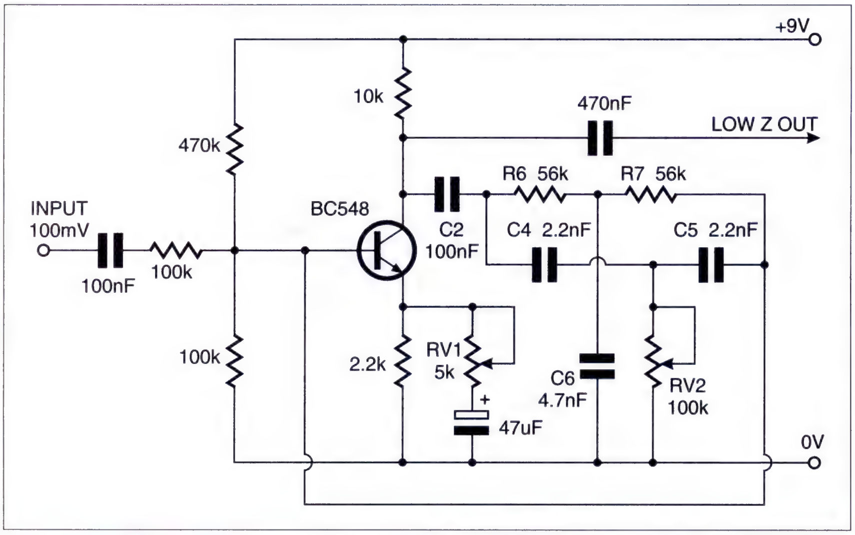
CIRCUIT & DESIGN

IDEAS FOR EXPERIMENTERS

Simple Waa-waa circuit

THIS CIRCUIT can be incorporated in guitar amplifiers or even built up as a freestanding pedal effect.

A phase shift RC oscillator makes up the basic circuit. C4, C5, C6 and R6, R7, RV2 make up the components of the bridge that determine the operating frequency, by feeding part of the signal back to the base via C2.



The oscillator is held just short of actual oscillation, and waa-waa effect is achieved as certain frequencies are amplified more than others due to the 'instability' of the circuit.

The transistor used is not critical however it should have a gain of more than 150. An NPN type such as the BC548 or BC549 is suitable.

The values of C4, C5, C6 are chosen so as to emphasise the waa-waa effect on the higher audio frequencies. This gives the sound its brilliance. These values can be changed quite freely until the specific desired effect is achieved.

When adjusting the unit initially, RV1 is turned to its minimum value. RV2 is now adjusted to and fro until a point is found where an audible whistle appears, indicating oscillation.

RV1 is then adjusted until the oscillation just disappears. RV2 is then turned over its whole range, and if at any point oscillation reoccurs, RV1 is again adjusted until it ceases.

It should be possible to set RV2 to any value over its range of adjustment without any oscillation being apparent; this should also be achieved with the minimum possible value of RV1.

THIS MONTH'S WINNER!

Dual mode battery charger

I RECENTLY DECIDED to add a battery backup to my smoke detector system by using sealed lead-acid batteries. Then of course, I needed some type of charger.

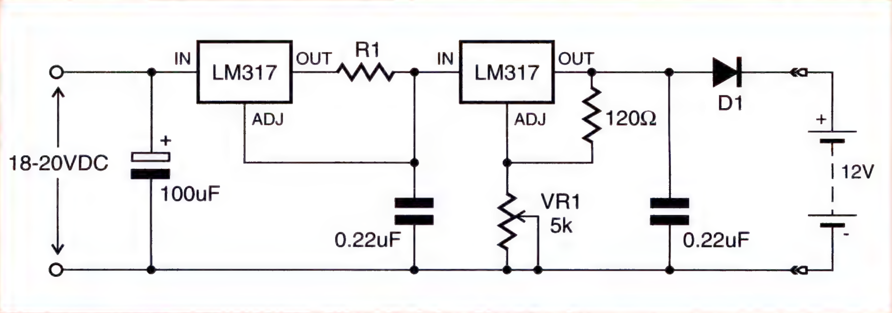
The problem with using a constant voltage type of charger is that the current flowing at or near full charge is quite low, while when the battery is discharged it is very high. On the other hand, with a simple constant current circuit the battery will be over-charged by the constant charging current.

I solved the problem by incorporating both types into the circuit shown here. Here, 18 - 20V DC is applied to the input of an LM317 regulator connected so that it functions as a constant current device. R1 determines the maximum current that will flow, and in my case I used a resistance of 4.2 ohms which gives about 300mA - use the formula R1 = 1.25/I to determine R1 for other currents.

At lower states of charge, or when the battery is completely discharged and the charging current is high, the second LM317 (even though it is connected as a voltage regulator) simply acts as a series resistance. As the battery reaches full charge, the regulator starts to act as a constant voltage source, and then becomes a trickle charger.

When the battery is fully charged VR1 should be adjusted to give a voltage at the battery terminals that falls in the range 13.5 - 13.8V. Diode D1 is included to prevent reverse current flow if the mains power fails.

David Allen
Findon, SA **$35**



IDEAS

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Win our 'IDEA OF THE MONTH' Prize! Valued at $469!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a Video Inspection Capture System from Allthings Sales & Services, which consists of a colour CCD camera, close-up lens set, adjustable stand and lamp, PCI video capture card and software, plus video cable and two plugpacks. You can find out more about this great system at the Allthings website; www.allthings.com.au.

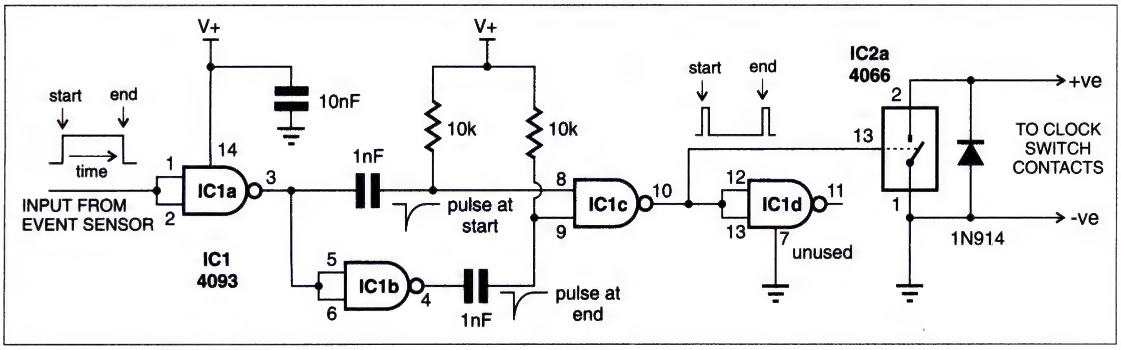
Driver for digital countdown timer

I HAVE USED elapsed time measurements for measuring electrical quantities such as amp-hour capacity of rechargeable batteries and capacitance of extremely large capacitors by measuring their discharge time constant.

In each case a sensor measures voltage, and switches OFF when a certain level is reached. For time elapsed measurement, I used cheap analogue quartz alarms available in the range $2 to $5.

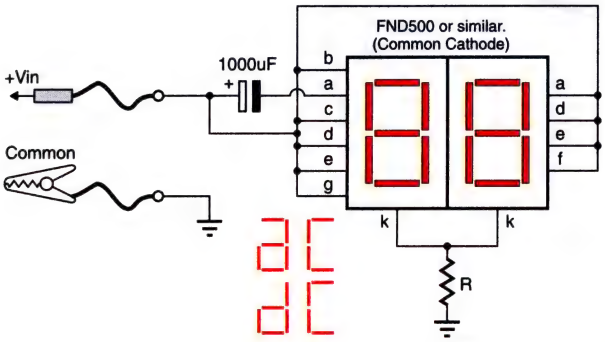
Digital countdown timers and sports stopwatches are available, and can be easily adapted. Most use the same button for start and stop functions. The switch contacts are accessible (except in wristwatches) and they tolerate a resistance of several hundred ohms as a make contact.

The following circuit takes the continuous output from the sensor to give a short pulse at the beginning, and a short pulse at the end of the activity. It uses a 4093 quad NAND Schmitt trigger to generate the pulses, plus a 4066 analogue switch to drive the clock switches - note that the circuit can operate over a supply range of +3V to +15V. In the rare case where the clock has separate start/stop switches, the start/end pulses could be buffered with IC1c and IC1d, and these used to drive two sections of the 4066 switch.



Victor Erdstein
Highett, Vic **$30**

7-segment AC/DC indicator



THIS SIMPLE, but very visual, AC/DC indicator uses two common low-cost FND500-type seven-segment LED displays - and not much else.

When the input probe is monitoring a DC voltage, elements **b, c, d, e** and **g** are activated in the left-hand display (LHD), while segments **a, d, e** and **f** on the right-hand display (RHD) illuminate.

The 1000uF capacitor blocks the incoming DC level from segment **a** on the LHD, so the overall display will read "dC".

On the other hand, when the input probe applies an AC signal to the circuit, this is also passed to segment **a** on the LHD via the 1000uF coupling capacitor. The AC signal will only drive the display's LEDs during the positive half cycles, but now, all connected segments will be activated so the display reads "aC". The two variations are shown on the diagram.

The display brightness is set by the value of cathode resistor R. As you'd expect, this is a compromise between display brightness and how much current should be drawn from the circuit it's monitoring. Use the formula R = (Vin - 1.7)/0.01 ohms as a starting point, but remember that the current drain and LED brightness will vary significantly with the input voltage level - you could always replace R with a constant current circuit.

Author unknown
(please contact EA!) **$25**

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BY JIM ROWE

Low Cost Video Fader & Enhancer

Here's the design for a colour video fader that's very low in cost, yet at the same time easy to build and get going. It even includes a switchable enhancer circuit which lets you compensate for the inevitable losses, when you're doing basic editing and re-recording of your home video programs.

BACK IN THE APRIL 1998 issue, I described a fairly elaborate Video Fader and Wiper unit. It turned out to be a reasonably popular project, with hundreds of kits being sold by the various kit suppliers. However to some extent the circuit had been complicated by the horizontal and vertical wiping functions, and this tended to make the design a little tricky in terms of setup adjustments.

Since then, I've had a number of requests for a simpler unit that would hopefully be easier to get going. People don't seem to be particularly worried about keeping the wiping functions, either, particularly if this helps result in a cheaper and more compact unit. So there seems to be a definite need for a simple 'no frills' video fader, which is probably all that many people need for basic video editing.

That then was the spec for the current project. To be honest it's derived from the 1998 design, but by scrapping the need to perform either kind of wiping I've been able to do away with the need for two of the ICs, and also completely avoid any preset controls or setting up. With fewer controls I've also been able to fit it all into a smaller and cheaper box, as well.

So this new 'fader only' design is much simpler to build and get going, and significantly cheaper as well. I estimate that you should be able to build it for less than $59, even buying the parts individually.

Despite its simplicity and low cost it still provides smooth and reliable video fading up and down, without degrading the synchronising, video bandwidth or colour stability. And it even includes the same video enhancer circuitry as the original design, so you can add a little judicious 'high peaking' to compensate for video dubbing losses.

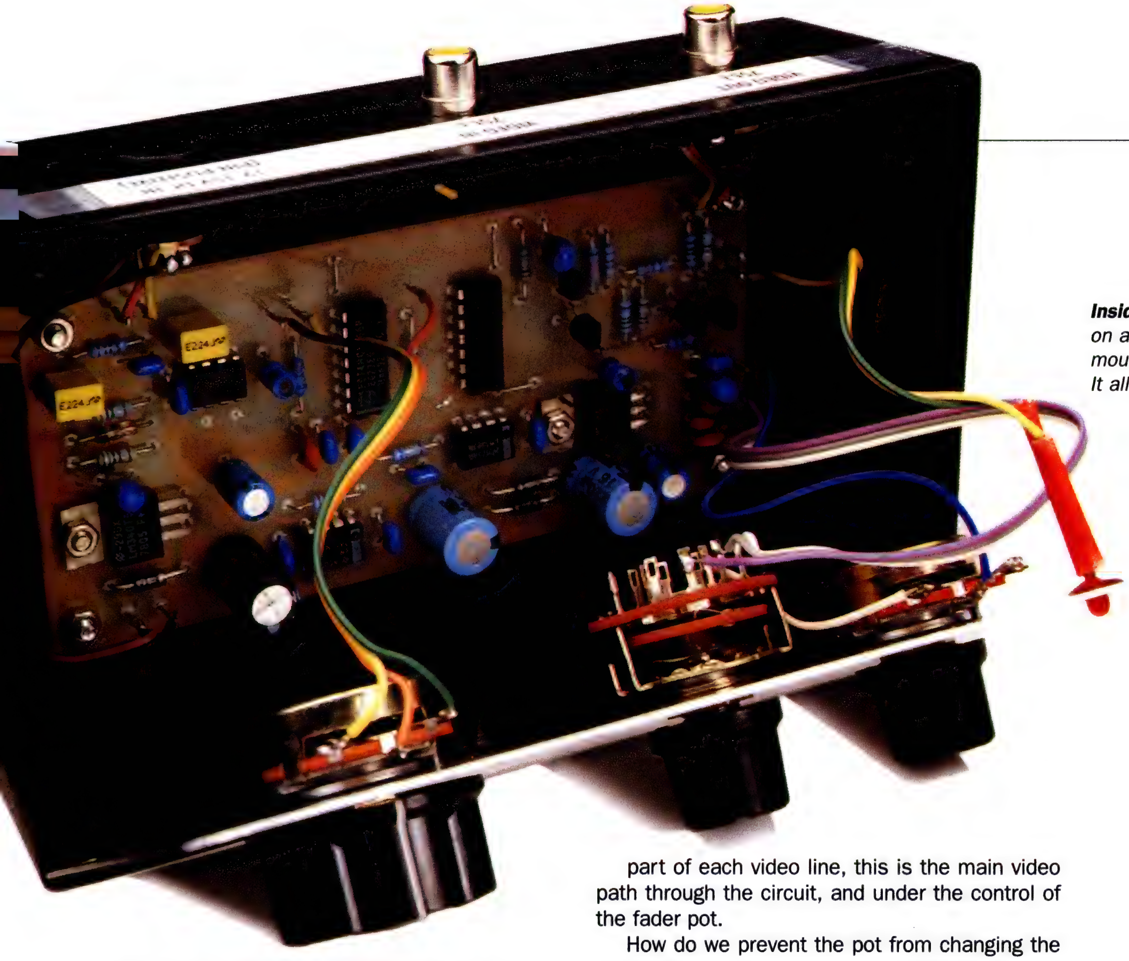
It all runs from a standard 12V DC plug pack or 12 - 15V battery supply, by the way, making it quite suitable for 'field use' if it's needed. Total current drain is less than 120mA.

How it works

If you're at all familiar with the April 1998 design, you'll find quite a lot this circuit pretty similar. There's just somewhat less of it!

The basic idea of this kind of fader is that unlike an audio fader, we can't simply vary the amplitude of ALL parts of the video signal –

__Apart from__ the main fader control itself, the only other controls are for selecting and adjusting the degree of video enhancement you need – if any.



Inside, just about *everything fits on a small PC board which mounts on the bottom of the box. It all runs from a small plug pack.*

that would upset the synchronising and colour stability. We can only allow the fade control to vary the amplitude of the *active* part of each video line, leaving the 'hidden' sync pulse and colour burst sections untouched.

This is done by a system of rapid switching, as we'll see shortly.

As you can see from the schematic resistor R1 first terminates the incoming video signal with 75 ohms, to match the input cable correctly. The signal then passes through coupling capacitor C1 to the input of U1, an NE5534 low noise op-amp connected here as a wideband unity gain buffer amplifier.

Although C1 obviously doesn't pass the DC component of the video signal, we effectively restore this again by means of an active clamping system. This uses analog switch U2d to connect the junction of C1, bleed resistor R1 and the input of U1 to a 'reference blanking level' of +0.6V DC (developed across diode D4), during the colour burst interval of each video line. Don't worry for the present about exactly how this is done; just note that as a result, the blanking level of the video signal entering and leaving U1 is effectively clamped at +0.6V.

The video fader pot RV1 is connected between the output of U1 and this blanking level, as you can see. So the pot can be used to select whatever proportion of the video signal we want – anything from the full amplitude, at the top, right down to zero at the bottom.

The output from the pot is taken via analog switch U2a to the base of transistor Q1, which is the first stage of the output video buffer amplifier. As switch U2a is turned on during the active part of each video line, this is the main video path through the circuit, and under the control of the fader pot.

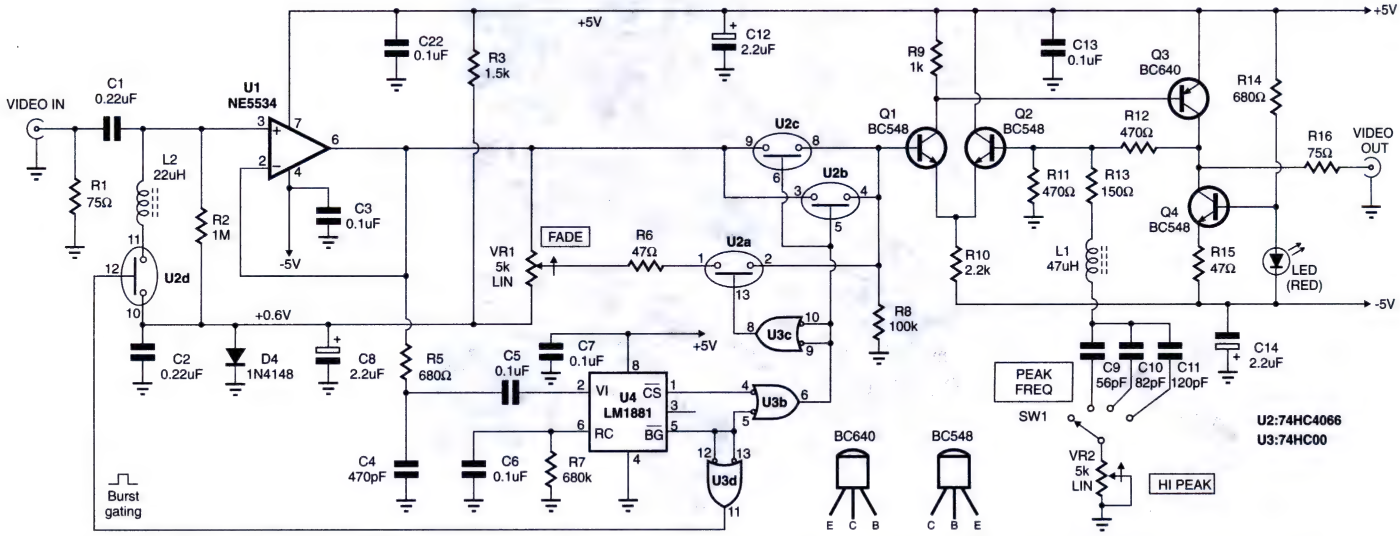
How do we prevent the pot from changing the synch pulses, or the colour bursts? Simply by turning *off* U2a whenever these are present, and turning *on* paralleled switches U2b and U2c instead. As you can see these switches simply bypass the pot, allowing the sync pulses and bursts to pass straight through to the output buffer without any disturbance.

The output buffer amplifier is exactly the same as that used in the earlier design, with transistors Q1-Q3 providing the voltage gain and Q4 providing Q3 with a constant-current collector load. The overall gain of the amplifier is set by feedback resistors R12 and R11, and the end result is a low distortion video amplifier with a bandwidth of over 10MHz and a gain of 2.0 – to compensate for the loss in R16, the output cable back-terminating resistor.

Note that the LED is used to establish a voltage reference for the base of Q4, as well as serving as a power-on indicator.

The components connected across R11 via resistor R13 are to allow a small amount of video enhancement, by means of a simple 'treble boost' circuit which raises the amplifier gain by a maximum of about five times (+8dB) at a selected upper video frequency. Here switch SW1 allows selection of the peaking frequency, by choosing either C9, C10 or C11 (or none, for a 'flat' response), and the selected capacitor forms a series resonant circuit in conjunction with inductor L1. Pot RV2 allows the actual amount of peaking to be adjusted, by varying the amount of series resistance, while fixed resistor R13 sets the minimum total impedance and hence the maximum peaking level.

So that's the basic signal processing path



__As you can see__ from the main schematic above, there isn't much in it – thanks to U4, which derives all the key switching signals. Below is the power supply circuit, delivering plus and minus 5V rails from the plug pack input.

through the circuit: blanking level clamp, input buffer, fader pot, video component switching and finally the output buffer and optional peaking. Now let's see how those analog switches are controlled, so the right things happen at the right times...

Most of the work for this is done by U4, a low cost LM1881 sync separator chip. This is fed with the video signal from input buffer U1, as you can see, via R5 and C4 (forming a low-pass filter, to block colour information) and coupling capacitor C5.

The LM1881 is a very powerful chip, which takes the incoming video signal and derives from it a bunch of useful sync and timing signals. For example at pin 3 it produces vertical sync pulses, and at pin 7 a signal indicating the odd and even fields of the video. We're not using these signals here, but we *are* using two other signals it delivers: a full composite sync signal at pin 1, and a colour burst gating/back porch clamp signal at pin 5.

We make use of the burst gate signal by first inverting it via U3d, to produce a positive-going version, and then use this to control our input blanking level clamp switch U2d. That's how the switch is turned on only at the correct time during each 'back porch' of the video blanking pulses, for correct level clamping. (Series inductor L2 is used to prevent the clamp from disturbing the incoming colour bursts, by the way.)

Both the composite sync and burst gating signals from U4 are also fed to U3b, which is used here as an active-low NOR gate. As a result the output of U3b goes high only during *either* the horizontal and vertical sync pulses, or the colour burst intervals. And as you can see this signal is then used to control video switches U2b and U2c, so they're turned on only at these times. And when those switches are turned on, inverter U3c is used to turn off video switch U2a, so the video fader setting can't produce any shunting of the sync pulses or colour bursts.

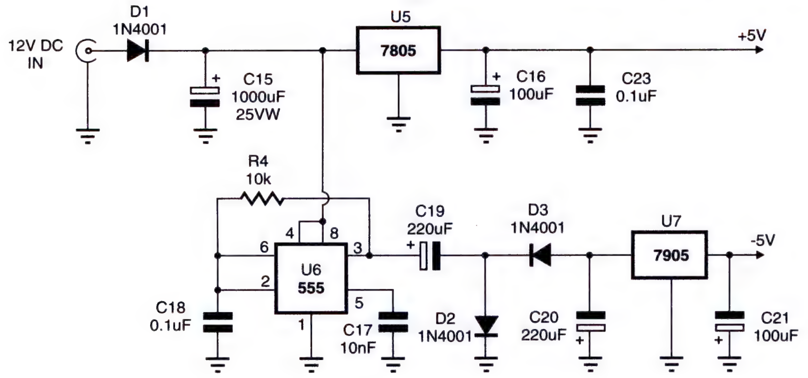
The nett result is that U2b-c pass the sync and colour bursts straight through when these occur, but the rest of the time U2a passes the video signal level selected by fader pot RV1. Nifty, don't you think?

The power supply circuitry for the fader is exactly the same as before. Positive regulator U5 is used to derive a regulated and smoothed +5V DC rail for both the logic circuitry and the video buffers, while 555 timer U6 is used as a self-oscillating 'charge pump' DC-DC converter, with diodes D2 and D3, to produce an unregulated -10V supply rail from the incoming +12V DC. This is then regulated by U7 down to -5V, to provide the negative rail for U1 and the output video buffer.

Diode D1 is used to prevent damage to the power supply circuitry in the event of accidentally connecting the +12V plug pack or battery with the wrong polarity.

Construction

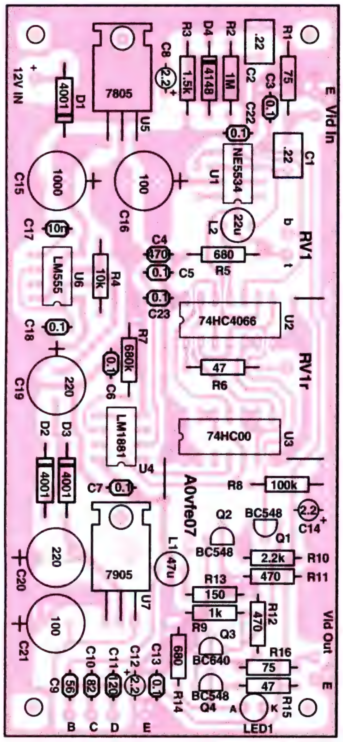
Building the fader is fairly straightforward, because most of the parts are mounted on a small PC board measuring 127 x 58mm, and



coded A0vfe07. The only components not mounted on the board are the actual fader pot RV1, the enhancer switch SW1 and pot RV2, the LED and the video and power connectors.

As you can see from the photos the pots, switch and LED are mounted on the front panel/lid of the utility box used to house the project. The video and power connectors are mounted on the rear of the box. The box itself is a low cost 'UB1' plastic jiffy box, measuring 160 x 96 x 55mm, with the PC board mounted on the bottom with four 10mm long M3 countersink-head screws, fitted with extra M3 nuts as spacers.

Fitting the smaller components to the PC board shouldn't present any problems if you use the overlay diagram and the internal photo as a guide. The main thing to watch is that you fit all of the polarised parts the correct way around, by following the diagram as carefully as possible. This applies particularly to the ICs, diodes, transistors and polarised capacitors.



Everything else is fairly non-critical, but I suggest that you fit the resistors and small capacitors in a systematic fashion to make sure you fit the right values in the right places. It's probably also a good idea to fit the three wire links to the board first, to make sure that you don't forget them.

You might want to fit PCB terminal pins to the board at the video input and output points, and also at the 12V DC input point, to make it easier to fit the wires leading to the box connectors when the PC board is mounted inside the box. For the same reason I also fitted pins for the connections to the components mounted on the front panel – the three connections to RV1, the two to the LED, and the four to enhancer switch SW1 and pot RV2.

When you've mounted everything on the PC board, you can put it aside for a while and prepare the box and lid. A photocopy of the front panel artwork can be used as a template to mark out and drill/ream the holes for the controls and LED, while you should be able to mark and cut out the three holes for the connectors using the photo as a guide. Their exact positions on the rear of the box are not critical.

You can also use a photocopy of the PC board pattern as a guide to drilling four 3mm holes in the bottom of the box, for mounting the board. The holes can be countersunk on the outside, to allow the screwheads to be flush.

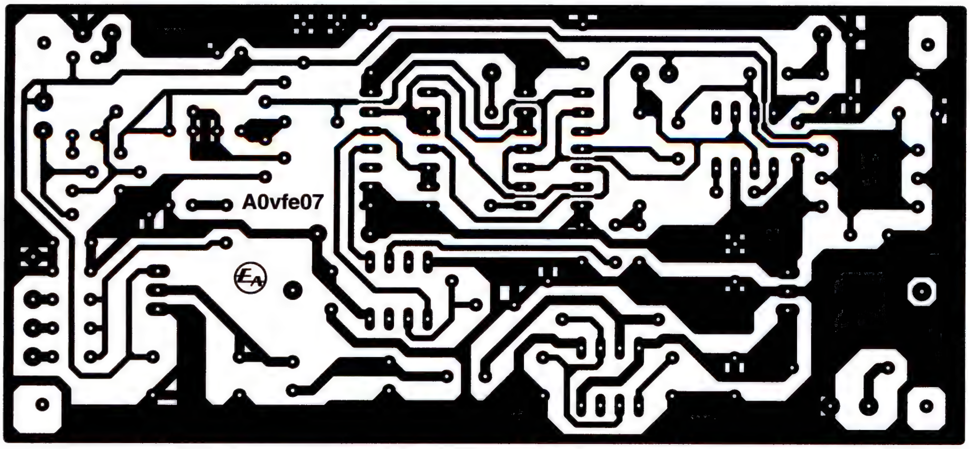
A dress front panel can be made using thin adhesive-backed aluminium foil, of the type available in A4 sheets. Most photocopiers will accept half a sheet, allowing you to make a direct transfer from the artwork shown. Just be careful when you're sticking it to the front of the box!

Once the panel is prepared and attached to the box lid, you can mount the controls (after cutting their spindles to the correct length for the knobs) and mount them to the panel, then adding the knobs. You can also glue the LED into its hole

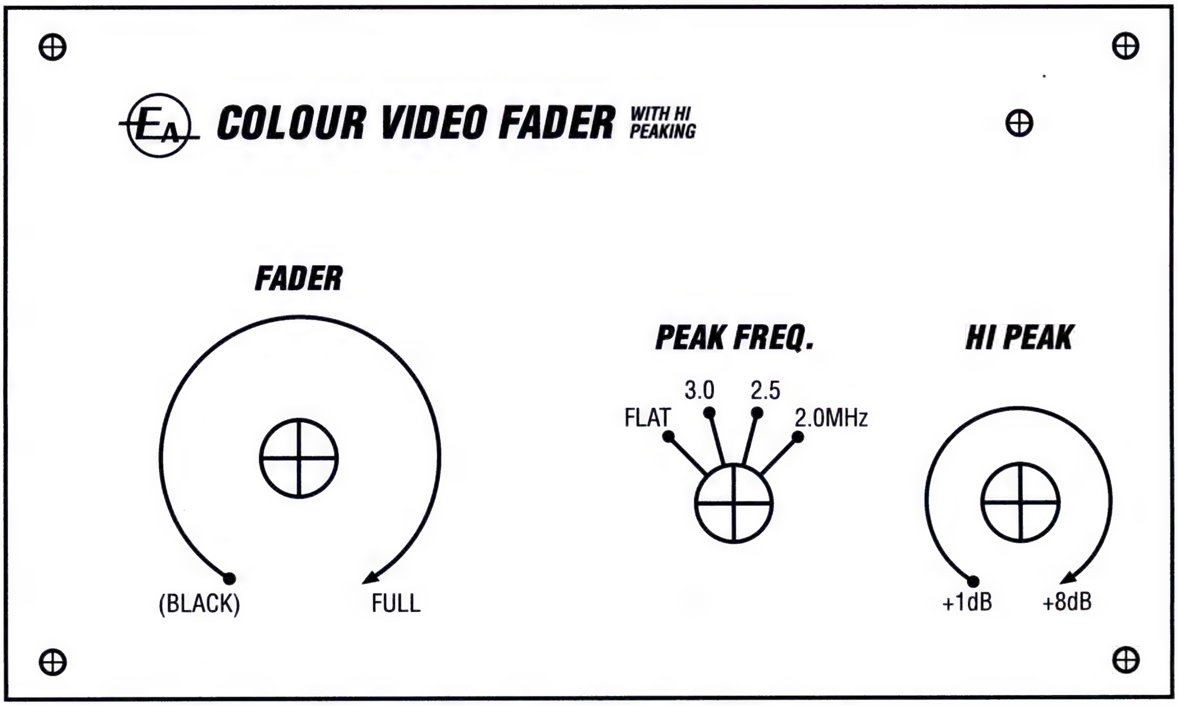
PARTS LIST

resistors	
R1,16	75 ohms
R2	1M
R3	1.5k
R4	10k
R5,14	680
R6,15	47 ohms
R7	680k
R8	100k
R9	1k
R10	2.2k
R11,12	470 ohms
R13	150 ohms
RV1,2	5k linear pot
capacitors	
C1,2	0.22uF MKT
C3,5,6,7,13,18,22,23	0.1uF monolthic
C4	470pF ceramic
C8,12,14	2.2uF 35VW TAG tant
C9	56pF NPO ceramic
C10	82pf NPO ceramic
C11	120pF NPO ceramic
C15	1000uF 25VW electro
C16,21	100uF 10VW electro
C17	10nF monolithic
C19,20	220uF 10VW electro
semiconductors	
U1	NE5534 op-amp
U2	74HC4066 quad analog switch
U3	74HC00 quad NAND gate
U4	LM1881 sync separator
U5	7805 +5V regulator
U6	LM555 timer
U7	7905 -5V regulator
Q1,2,4	BC548 NPN transistor
Q3	BC640 PNP transistor
D1,2,3	1N4001 1A diode
D4	1N4148 signal diode
miscellaneous	
L1	47uH RF choke
L2	22uH RF choke
LED1	3mm red LED

PC board, 127 x 58mm code A0vfe07; 15 x 1mm PCB terminal pins; plastic utility box, 160 x 96 x 55mm; single pole 4-position rotary switch; 1 x 30mm control knob, 2 x 20mm control knobs; 2 x RCA socket (yellow), single hole mounting; 1 x 2.1mm concentric DC power socket; 12V 200mA DC plug-pack power supply; 4 x 10mm x M3 machine screws with 8 x M3 nuts and 8 x star lockwashers, for PCB mounting; hookup wire, 4 x small rubber feet, etc.



***At left** is the PCB pattern, shown actual size for those who make their own boards. The board overlay diagram is shown at top to guide you in fitting the components.*



***Here's the artwork** for the front panel, again actual size so you can use a photocopy for your panel (and as a drilling template).*

from the rear, with a small quantity of epoxy resin adhesive.

Then it's simply a matter of mounting the PC board assembly in the bottom of the box, and making the various off-board connections using light duty hookup wire. Your fader should then be ready to try out, after a final check to ensure that you've placed all components correctly and not made any accidental shorts while soldering them to the PC board.

Checkout time

There's actually very little involved in checking the fader, and virtually no setting up to do. All you should need to do is connect up the plug pack supply or other 12-15V DC source, and check that the power supply circuitry is working correctly.

As soon as power is applied, for example, check that the LED is glowing. If it's not, you've either connected it in with the wrong polarity, or made some other wiring error – either with the connections for the 12V DC input, or the polarity of diode D1. Or you might have accidentally swapped the two regulators U5 and U7. So if there's no glow, remove the power quickly and track down where you've made the error. Fixing it should make the LED glow correctly, and if you check the +5V and -5V supply rails with a DMM, you should find that they're both within about 150mV of these values.

Assuming that you haven't made any other blues in fitting the ICs or transistors, your fader should now be capable of working. So try feeding some video through it from a VCR or camcorder, and connect the output to a monitor or TV receiver video input to check what it's doing.

First of all, turn the fader pot to the fully clockwise position, and set the Peak Freq switch to the Flat position to disable the enhancement circuit. The incoming video should simply pass straight through the fader, without any noticeable degrading at all.

If you now turn the fader pot slowly anticlockwise, the picture contrast and colour saturation should fade smoothly and with no effect on picture locking or stability. By the time you reach the fully anticlockwise position, the picture should be black; but turning the pot back up again should restore both contrast and saturation to their original levels.

That's it as far as fader operation is concerned. However if you are doing a video transfer and want to introduce a bit of HF peaking to 'sharpen it up', this is done simply by turning the Peak Freq switch to one of its three 'live' positions, and then adjusting the amount of peaking using the Hi Peak pot.

The idea is to add no more peaking than is necessary to achieve an improvement in the apparent picture sharpness. Too much, and you'll get annoying 'ringing' – multiple white and black lines to the right of vertical edges in the picture.

The switch is arranged so that you can try peaking at 3MHz first, and only progress to the lower frequencies if you really need to. This is because the lower the peaking frequency, the harder it is to achieve a useful enhancement. ■

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SERVICE**MAN**

Is this the **biggest** service job ever?

The biggest service job you've ever heard of, the most remote job we have ever reported, and more on wrongly labelled components - there's something for everyone in this month's column.

WE START this month with a story you'll find hard to believe. What began as a simple washing machine repair became a major operation involving dozens of people and lots of money. This incredible yarn comes from Kevin Summers, of Seymour in Victoria. See what you make of his adventures...

Let me start by providing some background information. I am the owner of a small service center in central Victoria and we cover service for all domestic appliances and brown goods. We are also warranty agents for most large manufactures. Sufficient time has now passed to allow publication of the details of this particular job.

It involved a U/G Email washer, the District Radio Inspector, The Police Department, the R & D section of Email in SA and the Area Technical Inspector for the SECV. It also covered a period of about four weeks and a handful of lost hair from my topknot.

We had a call to service an U/G Email washer that had an intermittent out-of-balance fault. The machine was one of the early electronic units from Email, and had been working well for about three months before the client moved into another flat, in the same block of units.

A service technician was dispatched to the site and the result was a 'No fault found'. The client was advised to contact us if the fault re-occurred. After four days we had a recall.

This time we took the washer into the workshop. After inspection and cycle testing couldn't fault it, we contacted the Email Tech Rep. After a number of recalls and replacing, among other things the electronic control PCB, wiring loom and lid switch assembly, Email finally exchanged the machine for a new one. With fingers crossed, we delivered it and hoped that it was the last we would see of the problem. Alas it was not to be.

A few days later we had the dreaded phone call. This time the customer had just turned the machine off. Upon arriving, sure enough the machine was in an out of balance condition. At this stage I contacted the R & D Dept of Email in Adelaide and obtained permission to pursue the fault to its conclusion. As luck would have it that morning we had our local Radio Inspector call in for his usual cup of coffee and a chat. In passing, I mentioned the washer.

The game's afoot!

At his suggestion we started to investigate the possibility of radiated RF interference causing the fault with the microprocessor. As the location is in an industrial area and next door to the regional Police Station this had possibilities.

The next day bright and early I went to the flat armed with a DF loop and Field Strength meter. The machine was playing up but alas no joy with the RFI.

I then connected a CRO to the mains and lo and behold, a 40V p-p signal, at approximately 15 to 20MHz was present. To try to find out the exact times of this interference, I left the CRO connected to an outlet in the flat and suggested that the owner turn it on occasionally. If there was no interference she could do the washing.

Over the next few weeks the customer logged the times when the fault occurred and this was between 7:30am to about 4pm, but only during the week. My early suggestion to only wash in the afternoon or on the weekends was not received very well. Fortunately the customer was a good sport. We then fitted a computer line filter to the power outlet and this allowed the customer to use the machine without restriction.

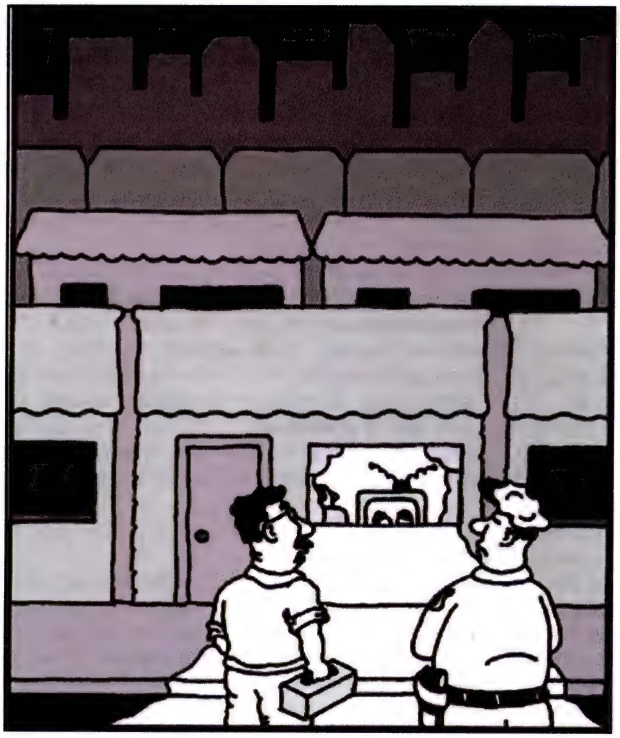
The next step was to try to locate the source of the interference. So with CRO and isolation transformer in hand I went to the Police Station to see if it was present there. This is where I ran into a brick wall!

To test the mains in the station required written clearance from Police Headquarters in Melbourne. The request took two weeks to be cleared, only to find there was no interference. Bugger it!

I then enlisted the help of the Area Technical Inspector from the State Electricity Commission. This would allow us access to any location without any hold ups. The upshot was that we found the interference on one phase only, hence moving the machine from flat 2 to flat 7, from one phase to another, caused the fault to appear.

The culprit...

After checking, and shutting down the power to five factories, two Government office buildings and various private houses we arrived at a block of flats about 600 metres up the road. It was just on 12 o'clock and we



had the interference present. Then suddenly it disappeared. First thought was that someone had shut down a machine for lunch. As we were contemplating where to go next, a resident of the flats walked out to the drive so on the spur of the moment I asked if he had just turned off any appliances.

His reply was, "Yes, the TV." Just for the hell of it I asked him to turn it back on again. Bingo! The problem was back. The set was a Sanyo CTP 7620.

On instructions from Email, we proceeded to purchase the TV set and on investigation found two dry joints on the main filter electros (C310 and C311) in the power supply. Email required the set in SA so that a permanent solution to the fault could be found. The result was the fitting of a ferrite filter to the active line of the washer.

It appears that the out-of-balance switch in this machine has a low voltage pulse supplied to it. If the switch goes open the pulse disappears and the microprocessor shuts the machine down. The interference was causing the signal to be distorted and this was the cause of the fault.

Some of the interesting aspects of this case are:

1: The reason that we assumed that the interference was coming from the Police Station or commercial premises was the times and duration of the fault.

2: It transpired that the owner of the TV set was a night shift worker who turned the set on about 7:30 in the morning and left it on until he went to work in the early afternoon – and he wasn't home at the weekends.

3 It is amazing that the owner of the set could even watch it, let alone why he didn't get it fixed.

4: After the set was removed from service, four residents from the block of flats informed us that their faulty digital clocks had started to work OK again.

Also, the head of the R & D section in SA informed me he had the same model Sanyo TV. After resoldering his dry joints, the clock in his stove rectified itself as well. It had been running fast intermittently.

All in all an interesting and unusual set of circumstances, but a highly fruitful exercise. The cost to Email was in excess of $1200 (including purchase of the TV set). However they considered it to be good value for money.

I didn't charge for the loss of hair.

Now isn't that something? We have told of some complex searches in the past, but I can't remember one that involved so many people or so much geography. I mean, most jobs involve the owner and the serviceman, and are located in either the home or the workshop. Kevin's story goes from flats to factories to an interstate manufacturer, and even visits the local Police station.

As I said at the top, the story is almost unbelievable. But I can quite imagine that it's true. Many microprocessor controlled devices are proving very susceptible to EMI, hence the new conformity rules. However, as this story shows, damaging EMI can arise in old, non-conforming appliances and can lead to the most unexpected symptoms.

Thanks for that story Kevin, and I hope your fee for telling it will cover the cost of a bottle of hair restorer.

Magnetisim? Who needs it?

Now we come to another 'almost unbelievable' story, this time from Archie Pearce of Point Sansom, in WA. Archie outlined his story in a letter to The Serviceman and has left it to me to tell the tale in my words. This is the gist of what he has to say...

A few months back we discussed the problem of missing magnetism in part of a high pressure car washing machine, and the story prompted comments from several readers who had suffered similar problems. Archie Pearce is one such reader and has told about a vexing problem that he was able to solve with a dash of typical Aussie ingenuity.

The story is about a Honda 'Robin' 5hp two stroke engine that was used to drive a portable air compressor.

According to Archie, he took the system to a remote country area but was unable to start the engine. He eventually discovered that the flywheel magnet had lost its magnetism and the rest of the story is about his ingenious fix.

(A brief description of magneto ignition, for those unfamiliar with the technique.

A strong magnet in the flywheel generates a current in a coil mounted close to the edge of the wheel. The current is at it's greatest as the magnet passes the coil, and while this current is flowing, it

A LOUD BANG AND WAVES OF SILENCE TOLD ME SOMETHING WAS NOT RIGHT

is interrupted by a cam operated switch.

As the switch opens, a high voltage is induced in the coil and this is conducted to the spark plug to ignite the charge in the cylinder. Magneto ignition is simple, efficient and usually very reliable.)

Archie was faced with a long drive back to civilization, without even starting the job that took him to the bush in the first place. So he looked about for some way to overcome his difficulty.

As is common in many country towns and remote stations, there were a number of derelict vehicles lying around and one of these caught Archie's eye. It was a 1967 Valiant utility and its ignition system was still intact. Using the Valiant's ignition coil and a few lengths of cable, Archie was able to cobble together a rough Kettering ignition system to get the Robin running.

Unlike magneto ignition, the Kettering system requires an external current supply and Archie's only battery was in his car. So to minimise the chance that he would be stranded with a flat battery, he salvaged an ammeter from one of the wrecks and incorporated that into his lashup, along with his multimeter to monitor the system voltage. He assures me that everything worked like a charm and he was able to finish the job he had gone bush to undertake.

So the loss of magnetism is not as rare as one might think. And with a bit of cunning one can often compensate for the loss. Thanks for that little story Archie. I quite enjoy these simple and amusing tales and I hope our readers do, too!

Those &%$#*@ electros!

Now the last story for this month, like the first one, refers back to an item in a previous column. This one comes from Robert Hitchin, of Burpengarry in Queensland.

The October '99 article on wrongly labelled parts brings to mind a repair to some of my own equipment that went horribly wrong for similar reasons. The item concerned is a Yamaha E10AR Electone organ which I bought in 1973 and still have, although I don't play very often these days. The E10 is a large instrument with two 61 note keyboards and 25 note pedal board. I'd had it for about five years when it developed a fifty cycle hum that ran through everything.

As I was busy at work and it was close to Christmas, I decided to get the Yamaha technician to have a look at it. He replaced all the electrolytic capacitors on the combined main amp and power supply board and the problem was solved, for a while anyway.

Three years later the problem recurred.

This time I had a bit of spare time and, as I had also acquired a manual for the beast, I decided to do the job myself. Fortunately the room housing the organ could be closed off from the rest of the house so that I could dismantle it and leave it for a day or two if necessary.

After removing the front and back panels, removal of the amplifier and power supply is straight forward as it lifts out on an aluminium chassis, similar to some of the old valve chassis with the center cut out.

The cause of the problem was fairly obvious as the two 2200uF/80V capacitors were both leaking. Several other electros including three 1000uF/25V appeared suspect so the decision to replace all of them was made. Getting suitable capacitors was the next problem as, although Newcastle was well serviced with suppliers, some electros were in short supply and getting the 25V units was a real problem...until I found some 1000uf/63V units.

Bang!

On the basis that a bit of extra headroom would not go astray, I used these and soon had the instrument back together. At turn on all seemed well so I finished the assembly and put the instrument into its normal position in the room.

Later that day I decided to give the organ a work out and all went well until I applied some real volume. A loud bang followed by a pop and waves of silence told me something was not right.

When the main amplifier was again opened it was covered with the insides of the three 1000uF capacitors which had literally exploded while the two 2200uF units had popped their ends and were leaking all over the board. It was not a pleasant sight.

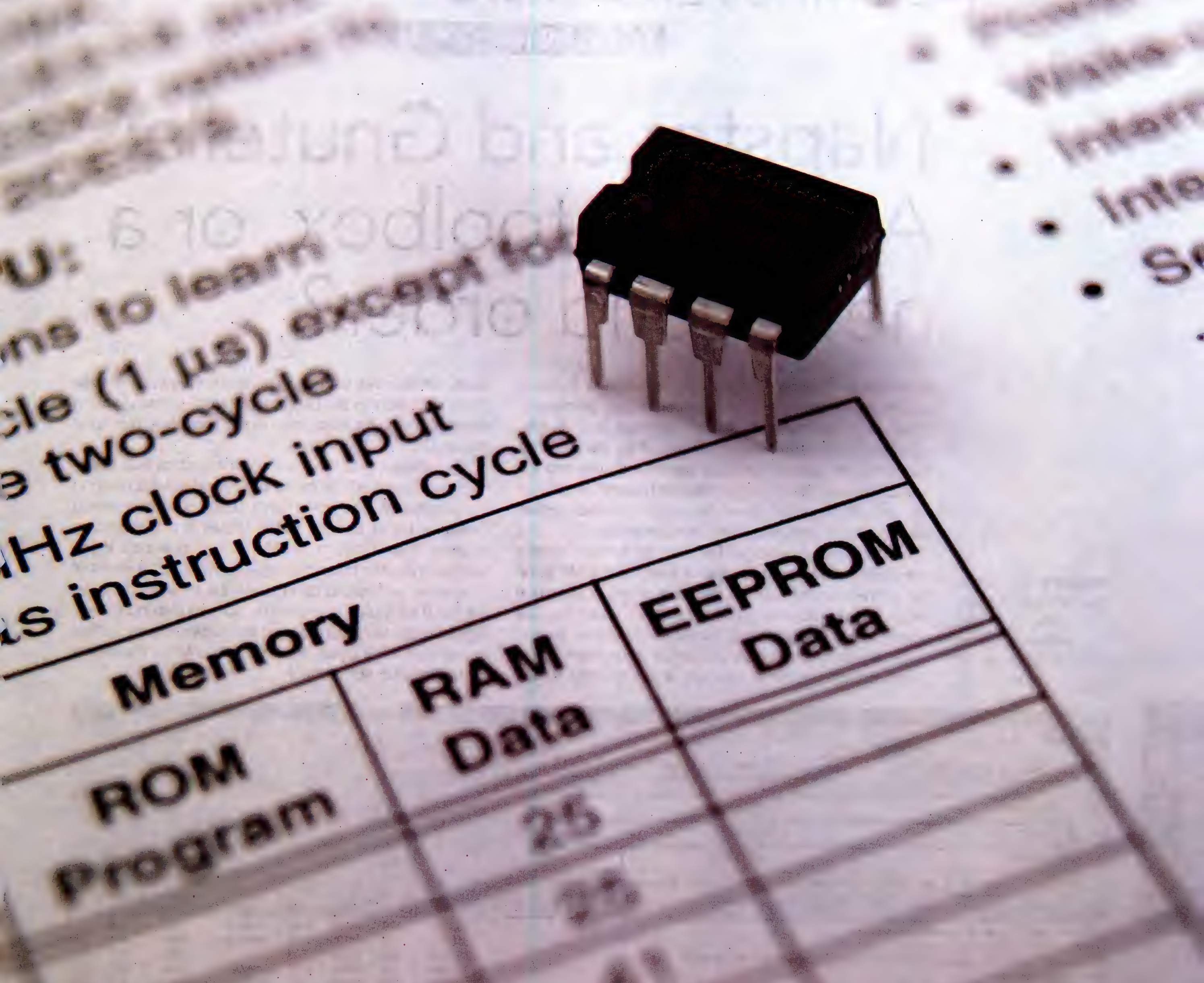
The board was again removed and cleaned, checking as I went to make certain that I had not done something stupid. On the under side of the board some of the tracks were missing while others looked decidedly black. Further investigation proved that one pair of diodes was open circuit, as were the transistors in the output stage. I made up a list of what I needed and went shopping.

The first place I went to was the shop where I had obtained the capacitors and the minute I mentioned that I had bought some, the owner asked if I had had any trouble. I told him the story and he admitted that they had since found out that the whole shipment had been wrongly labelled and were in fact 16V types. At least the man was honest.

The next problem was then the output transistors and their drivers as these were Japanese in TO3 cases and unlisted as far as we could tell. Detective work eventually led to using BD139s driving 2N3055s.

After it was all back together I took my courage in both hands and tried again. Everything held together but a certain measure of distortion was evident.

(continued on page 97)



8-pin PIC microcontroller

The PIC12C509 8-bit CMOS microcontroller from Microchip Technology is a static EPROM-based micro, featuring RISC architecture with just 33 single word instructions. The 12-bit wide instructions execute in one clock cycle, except program branches which take two cycles. Housed in a standard 8-pin DIP package, the chip features in-circuit serial programming for the 1024 x 12 EPROM, six bi-directional I/O ports and four oscillator-type options.

Being small, low-cost, efficient and extremely flexible, the 12C509 is ideal for mobile applications such as security devices and remote controls, plus logic circuits where a micro may not have been considered before - for example, timer functions, 'glue' logic and I/O interfaces/controllers.

Have a go at micro programming with the PIC12C509! You can pick one up from Jaycar stores for just $8.75 (Cat no. ZZ-8600), and there's heaps of useful information and programming tools out there on the internet - start at www.microchip.com. ■

Specifications

Package	8-pin DIP
CPU	On-board RISC
Instructions	33
Data path	8-bit
Instructions	12-bit
Clock speed	DC - 4MHz
Addressing	Direct, indirect and relative
EPROM	Static, 1024 x 12
I/O	6 bi-directional ports
Max I/O current	25mA
Supply current	<2mA @ 5V, 4MHz
Standby current	<1uA (typical)
Voltage range	2.5V - 7V

BY JEAN BAPTISTE CATTLEY

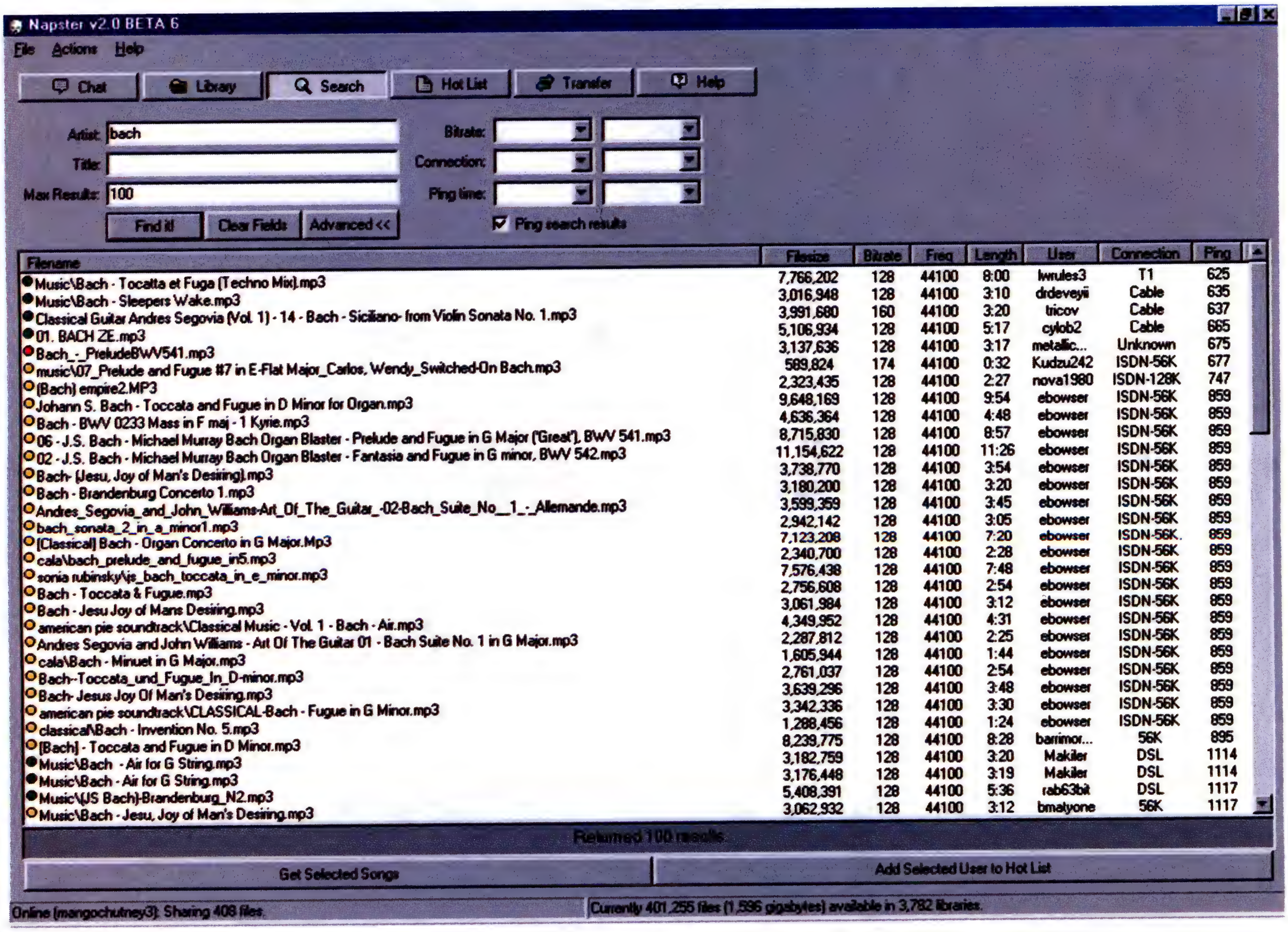
Napster and Gnutella: A Pirate's toolbox, or a new world order?

SEARCHING THE WEB for MP3s is often a fruitless task. With the vast majority of search results pointing to 404s, ratio servers or pages full of dodgy banner ads, what you really need is a tool designed for the job. That tool has been around for quite some time now, and it's called Napster. The principle behind Napster is simple: you run the Napster client, log onto a central server, search for the song you want, and download it.

Sounds like yet another MP3 site so far, but there's one crucial difference: instead of keeping the MP3s on the server, they're kept on the hard drives of everyone who's logged into Napster at the time. When you log onto Napster, the details of all the MP3s in your shared folder are sent to the server, which adds them to its global database. When you run a search, the server looks through this list of MP3s, and sends back results pointing directly to the files themselves - allowing you to download straight from the person who has the song you want.

This means that the bandwidth is distributed; everyone contributes a little bit so the speed is kept close to the maximum, and there isn't some poor overloaded fileserver trying to send MP3s to half a million people at once – all it has to handle is the searches themselves. This also takes the legal heat off in the event of problems; as Napster don't touch the files themselves, it's not their fault if someone decides to distribute copyrighted material... But more on this subject later. Suffice to say that if it's been recorded as an MP3, it's probably on Napster somewhere.

__Napster is the king__ of the MP3s on the Net. All of the files listed are situated on other people's machines, all over the world.



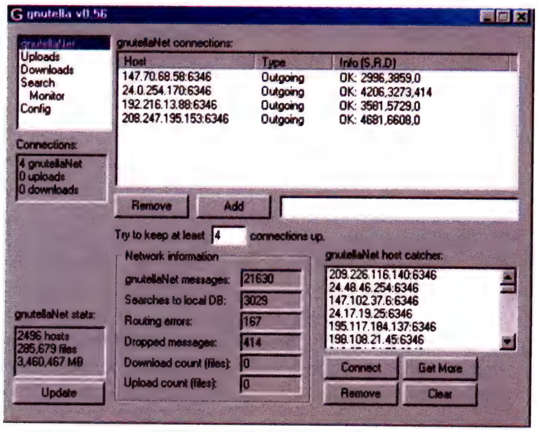
Artist: bach
Title:
Max Results: 100
Bitrate:
Connection:
Ping time:
☑ Ping search results

Filename	Filesize	Bitrate	Freq	Length	User	Connection	Ping
● Music\Bach - Tocatta et Fuga (Techno Mix).mp3	7,766,202	128	44100	8:00	lwrules3	T1	625
● Music\Bach - Sleepers Wake.mp3	3,016,948	128	44100	3:10	drdeveyii	Cable	635
● Classical Guitar Andres Segovia (Vol. 1) - 14 - Bach - Siciliano- from Violin Sonata No. 1.mp3	3,991,680	160	44100	3:20	tricov	Cable	637
● 01. BACH ZE.mp3	5,106,934	128	44100	5:17	cylob2	Cable	665
● Bach_-_PreludeBWV541.mp3	3,137,636	128	44100	3:17	metallic...	Unknown	675
○ music\07_Prelude and Fugue #7 in E-Flat Major_Carlos, Wendy_Switched-On Bach.mp3	589,824	174	44100	0:32	Kudzu242	ISDN-56K	677
○ (Bach) empire2.MP3	2,323,435	128	44100	2:27	nova1980	ISDN-128K	747
○ Johann S. Bach - Toccata and Fugue in D Minor for Organ.mp3	9,648,169	128	44100	9:54	ebowser	ISDN-56K	859
○ Bach - BWV 0233 Mass in F maj - 1 Kyrie.mp3	4,636,364	128	44100	4:48	ebowser	ISDN-56K	859
○ 06 - J.S. Bach - Michael Murray Bach Organ Blaster - Prelude and Fugue in G Major ('Great'), BWV 541.mp3	8,715,830	128	44100	8:57	ebowser	ISDN-56K	859
○ 02 - J.S. Bach - Michael Murray Bach Organ Blaster - Fantasia and Fugue in G minor, BWV 542.mp3	11,154,622	128	44100	11:26	ebowser	ISDN-56K	859
○ Bach- (Jesu, Joy of Man's Desiring).mp3	3,738,770	128	44100	3:54	ebowser	ISDN-56K	859
○ Bach - Brandenburg Concerto 1.mp3	3,180,200	128	44100	3:20	ebowser	ISDN-56K	859
○ Andres_Segovia_and_John_Williams-Art_Of_The_Guitar_-02-Bach_Suite_No__1_-_Allemande.mp3	3,599,359	128	44100	3:45	ebowser	ISDN-56K	859
○ bach_sonata_2_in_a_minor1.mp3	2,942,142	128	44100	3:05	ebowser	ISDN-56K	859
○ [Classical] Bach - Organ Concerto in G Major.Mp3	7,123,208	128	44100	7:20	ebowser	ISDN-56K.	859
○ cala\bach_prelude_and_fugue_in5.mp3	2,340,700	128	44100	2:28	ebowser	ISDN-56K	859
○ sonia rubinsky\js_bach_toccata_in_e_minor.mp3	7,576,438	128	44100	7:48	ebowser	ISDN-56K	859
○ Bach - Toccata & Fugue.mp3	2,756,608	128	44100	2:54	ebowser	ISDN-56K	859
○ Bach - Jesu Joy of Mans Desiring.mp3	3,061,984	128	44100	3:12	ebowser	ISDN-56K	859
○ american pie soundtrack\Classical Music - Vol. 1 - Bach - Air.mp3	4,349,952	128	44100	4:31	ebowser	ISDN-56K	859
○ Andres Segovia and John Williams - Art Of The Guitar 01 - Bach Suite No. 1 in G Major.mp3	2,287,812	128	44100	2:25	ebowser	ISDN-56K	859
○ cala\Bach - Minuet in G Major.mp3	1,605,944	128	44100	1:44	ebowser	ISDN-56K	859
○ Bach--Toccata_und_Fugue_In_D-minor.mp3	2,761,037	128	44100	2:54	ebowser	ISDN-56K	859
○ Bach- Jesus Joy Of Man's Desiring.mp3	3,639,296	128	44100	3:48	ebowser	ISDN-56K	859
○ american pie soundtrack\CLASSICAL-Bach - Fugue in G Minor.mp3	3,342,336	128	44100	3:30	ebowser	ISDN-56K	859
○ classical\Bach - Invention No. 5.mp3	1,288,456	128	44100	1:24	ebowser	ISDN-56K	859
○ [Bach] - Toccata and Fugue in D Minor.mp3	8,239,775	128	44100	8:28	barrimor...	56K	895
● Music\Bach - Air for G String.mp3	3,182,759	128	44100	3:20	Makiler	DSL	1114
● Music\Bach - Air for G String.mp3	3,176,448	128	44100	3:19	Makiler	DSL	1114
● Music\(JS Bach)-Brandenburg_N2.mp3	5,408,391	128	44100	5:36	rab63bit	DSL	1117
○ Music\Bach - Jesu, Joy of Man's Desiring.mp3	3,062,932	128	44100	3:12	bmalyone	56K	1117

Returned 100 results

Online (mangochutney3): Sharing 408 files.

Currently 401,255 files (1,596 gigabytes) available in 3,782 libraries.



gnutellaNet connections:

Host	Type	Info (S,R,D)
147.70.68.58:6346	Outgoing	OK: 2996,3859,0
24.0.254.170:6346	Outgoing	OK: 4206,3273,414
192.216.13.88:6346	Outgoing	OK: 3581,5729,0
208.247.195.153:6346	Outgoing	OK: 4681,6608,0

Connections:
4 gnutellaNet
0 uploads
0 downloads

Try to keep at least 4 connections up.

Network information
gnutellaNet messages: 21630
Searches to local DB: 3029
Routing errors: 167
Dropped messages: 414
Download count (files): 0
Upload count (files): 0

gnutellaNet host catcher:
209.226.116.140:6346
24.48.46.254:6346
147.102.37.6:6346
24.17.19.25:6346
195.117.184.137:6346
198.108.21.45:6346

gnutellaNet stats:
2496 hosts
285,679 files
3,460,467 MB

***At left is Gnutella**, similar to Napster, only decentralised, and not limited to MP3 files.*

Napster nags

Now, Napster isn't perfect, and there are some really annoying things about it that can drive you up the wall.

First up, there are a number of Napster servers out there, and for some reason, they're not linked, and you can't choose which one to join. This means that the whole Napster network is divided into pieces and you can't see what is on any of the other servers. So you have to take pot luck. The severs are usually pretty well-stocked, though; as I type this there are 406,031 files on the server I'm using, taking up over 1600GB - it would seem that you can find anything if you look long enough.

Also, you have the power to terminate any uploads you're providing at any time. While this is only right, it means that there's a good chance of getting kicked off in the middle of a file. Long-term Napster users therefore generally have a huge collection of half-completed songs that they're never going to find again. Of course, when half a dozen people start sucking up your bandwidth while you are trying to download the song *you've* wanted for the last six months, ones community spirit has a slight tendency to go out the window...

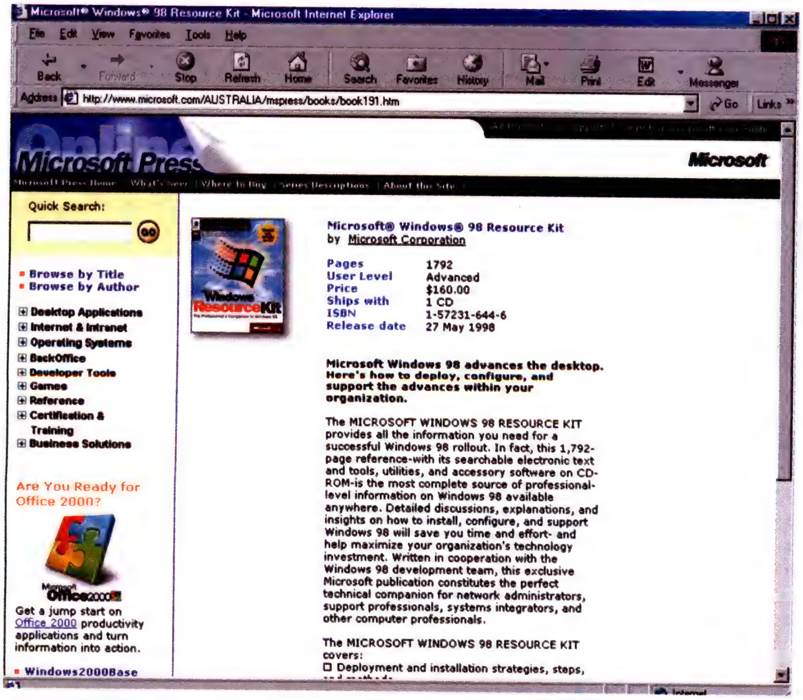
Apart from that, though, it's the fastest, easiest and most reliable way to find MP3s on the net today. Check it out at **http://www.napster.com**

COMMONSENSE, NOT PIRACY

The fact of the matter is, people distribute copyrighted MP3s. Probably 97% of the songs out there are pirated, and while it's directly against the copyright act to spread pirated material (not to mention extremely dodgy ethically speaking), there are several reasons why everyone continues to do it. First, it's virtually impossible to even think of enforcing copyright regulations on the global scale – each infringement is a separate case, and there are simply too many people involved to start running after them all.

This is especially true when you consider the global nature of the internet – imagine the legal hell involved for an American band trying to prosecute a German resident for sending a song to Japan... Indeed, trying to put a lid on MP3s can actually lose money for all concerned, as Metallica found when they tried to strike back at Napster and its users for distributing their songs. Their attempt to have over 300,000 users banned from the service failed rather miserably, and all they managed to do was to lose the goodwill of their huge listener base... Leaving the customer with a grudge against you is not perhaps the very best way to succeed in business.

I'm not condoning piracy, but things are going to change, and people that don't realise this are going to get hurt. You can't stop new technologies, you simply have to adapt to them. Look at colour photocopiers... When they first came out, copying centres had to keep detailed records of every single copy made, lest someone (and I'm not kidding here) use them to counterfeit money. Luckily, people got a handle on the concept, and commonsense prevailed – lets just hope the same happens for digital music.



http://www.microsoft.com/AUSTRALIA/mspress/books/book191.htm

Get a jump start on Office 2000 productivity applications and turn information into action.

Microsoft® Windows® 98 Resource Kit
by Microsoft Corporation

Pages	1792
User Level	Advanced
Price	$160.00
Ships with	1 CD
ISBN	1-57231-644-6
Release date	27 May 1998

Microsoft Windows 98 advances the desktop. Here's how to deploy, configure, and support the advances within your organization.

The MICROSOFT WINDOWS 98 RESOURCE KIT provides all the information you need for a successful Windows 98 rollout. In fact, this 1,792-page reference-with its searchable electronic text and tools, utilities, and accessory software on CD-ROM-is the most complete source of professional-level information on Windows 98 available anywhere. Detailed discussions, explanations, and insights on how to install, configure, and support Windows 98 will save you time and effort- and help maximize your organization's technology investment. Written in cooperation with the Windows 98 development team, this exclusive Microsoft publication constitutes the perfect technical companion for network administrators, support professionals, systems integrators, and other computer professionals.

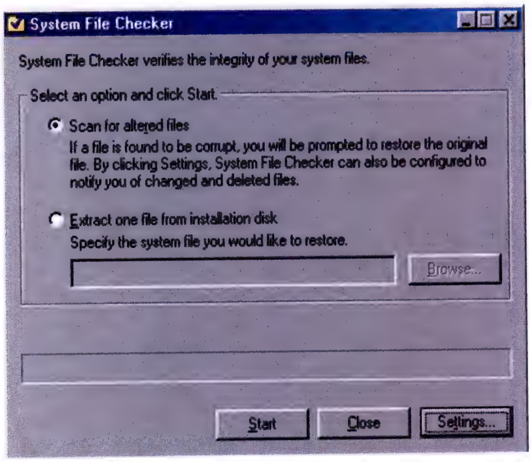
The MICROSOFT WINDOWS 98 RESOURCE KIT covers:
☐ Deployment and installation strategies, steps,

Gnu kid on the block

Of course, there are some design limitations in Napster - if the main server goes down everyone is out in the cold, you can only use it for MP3s, and its centralised nature makes it far too vulnerable to nuclear war or hungry lawyers.

This is where a new program called Gnutella comes in.

The System File Checker is a part of Windows 98, and can be very useful in fixing a broken system.



System File Checker

System File Checker verifies the integrity of your system files.

Select an option and click Start.

● Scan for altered files
If a file is found to be corrupt, you will be prompted to restore the original file. By clicking Settings, System File Checker can also be configured to notify you of changed and deleted files.

○ Extract one file from installation disk
Specify the system file you would like to restore.

Gnutella is very similar to Napster, but with two critical differences: it's not limited to MP3s, and more staggeringly it has *no* centralised servers. That's right, none. Gnutella is nothing more than a network protocol, and instead of requiring a main server to connect to, clients simply connect to each other. All you need is the IP address of one pre-existing Gnutella user, and your files and search requests will get distributed across the planet, daisy-chained from user to user, across the whole network.

Just as the original idea of the internet was to make it unkillable through redundant routing (though just a few bombs placed under a few major routers today would probably bring the whole net to its knees), Gnutella has no central point of weakness, and self-heals around any gaps that form.

With nobody to sue, and no high-traffic servers to go down, you can always get onto Gnutella. With hundreds of thousands of users doing their own dynamic routing, network partitions are unlikely at best. And with files not limited to any particular filetype, people can't even call it a piracy tool - it can just as well be used to exchange recipes, images or savegame files from quake as music.

Now, the very nature of the beast brings its own limitations; the number of searches sent through your system can easily soak up most of a 56k connection, so it's not the most efficient, and having to update all the hosts every time you start the program can mean it's a good 5 minutes before you get useful results.

Also, there's an *awful* lot of porn, spam, viruses, and generally unpleasant material out there. This is no fault of Gnutella, but it's something to be wary of – just because it's called 'curry recipe.html', doesn't mean it's not a link to 'the best XXX site on the web!!!!!!!!!!'. There are some very lame people out there who poison the well with as many fake keywords as they can, in order to get a few more hits on their pathetic websites. (The above just happened to me, and boy, was I annoyed.) Oh, and if you use Gnutella, don't even think of downloading any programs from it – it's just too tempting for Trojan writers to pass up.

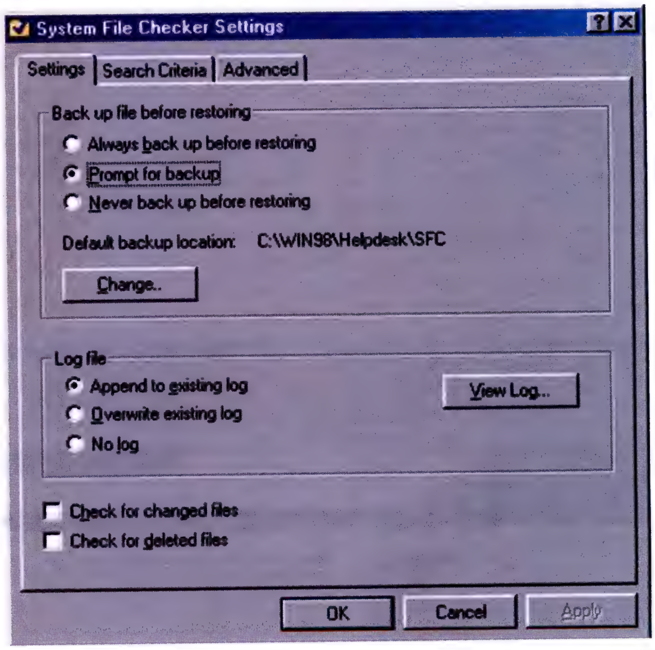
Check out Gnutella at **http://gnutella.wego.com**

Windows Reference

Is there a good reference text for Win95/98 that details the inner workings of the system, how the various files and directories are set up, the organisation of the registry, and such?

I work a lot with small business and domestic users of the system, and frequently get faced with a full re-install when it is obviously only a file that has been corrupted (the area is prone to power flicks) or a single setting that needs to be changed. And, of course, having done a re-install, I then have to re-install all the applications, when they are already on the disk, only Windows does not know it! I have tried saving all the .INI files and then returning them to Windows, but this still does not get them back on the desktop. A good text, rather than having to learn by trial and (mostly) error would be wonderful. (Bruce Burdekin, via email)

The best reference out there for this kind of thing is probably the Windows 98 Resource Kit. You get 1792 pages of exhaustive detail on installation, configuration, networking – the works. There's also a CD full of extremely handy little tools, and huge resources of searchable text - a must-have if you're professionally involved with 98. At $160, it's not cheap, but it's worth it. You can order a copy online at **http://www.microsoft.com/AUSTRALIA/mspress/books/book191.htm**. There's a Win95 version as well, for only $99.95. Check it out at **http://www.microsoft.com/australia/mspress/books/book105.htm.**



System File Checker Settings

Back up file before restoring
○ Always back up before restoring
● Prompt for backup
○ Never back up before restoring

Default backup location: C:\WIN98\Helpdesk\SFC

Log file
● Append to existing log
○ Overwrite existing log
○ No log

☐ Check for changed files
☐ Check for deleted files

One other thing; for a quick fix of your 98 system, try running SFC from the command prompt. This starts up the System File Checker, a handy little utility that checks the various DLLs, etc, that are installed by default, and can replace any that are corrupted, missing or changed – a real lifesaver, on occasion. ■

BY PETER PHILLIPS

So you think a **computer virus is a bad thing**? Maybe not, says Peter...

Topics this month include a reader suggestion on measuring wind velocity, which leads into a discussion on the factors that affect sound velocity. There's also a suggestion on instantaneous communication, more discussion on Telstra's deal for a second phone line, but first a look at the effects of computer viruses.

MOST READERS will have heard of the Love Bug virus, a nasty bit of code that in April allegedly caused worldwide damage costing billions of dollars. I first heard of the virus at 7.00am on the day it was released, and like everyone with email, I feared the worst. It seems this virus, like so many others, was aimed at those running Microsoft Outlook where the virus could make good use of the Outlook address book. My initial reaction was one of exasperation and anger, but when I realised my computer was not affected, I began thinking about the positive aspects of such a villainous act. What positive aspects you say? How can a virus be a 'good thing'? Well, consider this. Some time ago I compared computer development to the development of the motor car, and concluded that computers today are at Model T Ford status. The 'highways' linking computers are probably somewhat better, given the longer development time, but in general, the whole system still has a very long way to go.

Today we drive cars that are so much safer than ever before, but it was to take 40 years or more after the Model T before Ralph Nader made safety such an issue. Thousands of people had been killed simply because cars were not safe. And that's where the internet and computers are today: unsafe. True, you won't be killed by a computer system, but your stress levels will be pushed through the roof each time a virus catches you out.

Today the world is virtually dependent on computers, as evidenced by the Y2K bug. It seems reasonable to suggest therefore that if a couple of 20-year-olds can bring the computer world to its knees, then what would happen if some real experts where hired by a terrorist movement or an aggressive military establishment. My point is, each time a rogue programmer unleashes a virus, it shows up the weakness in the system, highlighting the need for better security.

And just as it was in the automotive industry, money won't be spent on internet safety until there's enough pressure from the computer industry. This will only come from users, not manufacturers, and every time a virus is released, this pressure increases. The internet must be made 'safe' if our dependence on computers is to continue. Every virus simply serves to highlight just how fragile the internet system is, making this a far greater security risk than the Y2K bug. Presently, as has been demonstrated so effectively, the world's computer systems are very vulnerable, given that the Love Bug virus was written in Visual Basic, a programming language we all have access to. Scary, isn't it!

Having got that off my chest, here's our first reader letter on a topic which is a spin off from our discussion on measuring water flow. This time it's about measuring air speed, but will our reader's idea work?

Measuring air speed

I have been considering an idea for an air speed measuring device that you might consider for an EA project. I am aware that sonic anemometers are commercially available, but I have never seen their principles described and this basic idea is original to me, although maybe not unique.

I assume that sound travelling against the wind requires more time to cover a given distance than sound in still air. Using this concept, I envisage a system comprising two frequency sources, a couple of gates, a 'speaker' and a 'microphone'. The distance between the speaker and the mic and the value of the lower frequency are all chosen so that sound travels the distance between the speaker and the microphone in a quarter of a cycle of the lower frequency. A frequency of 275Hz might give a path of 30cm or so. The higher frequency is chosen to suit the speaker and microphone, and I expect a practical system would operate at ultrasonic frequencies.

In calm wind conditions there would be a 90° lag in the arrival of the sound bursts when referenced to the lower frequency, and considering that the duration of the sound bursts is 50 percent of the time, we would see a tone at the output for 25 percent of the time. When the wind blows towards the speaker the arrival of the sound bursts will be delayed even further and the output duration would drop. When wind blows towards the microphone the sound bursts would arrive earlier and output duration would increase. Therefore the system will measure wind in both directions.

It could be a fairly simple circuit operating a cen-

> *tre zero meter, but a more useful system would have two microphones mounted, for example, north and east of the speaker. This would give everything needed for a wind speed and direction anemometer. The output of the microphones could be passed to a PC via a stereo sound card, where software would process the resulting 'WAV' file and drive on-screen speed and azimuth displays. I think I could manage the software development, but the electronic design is beyond me.*
>
> *Such a system would have significant appeal, as commercially available ultrasonic anemometers are quite expensive and lower-priced mechanical systems have maintenance and reliability problems. It would be more accurate than any other system except the best mechanical types, which are very difficult for the home constructor to calibrate. Calibration of my proposed system requires only a ruler and calculator. I look forward to your comments, even if they only point out a basic flaw in my understanding of the physics involved! (John Hill, Island Bay, NZ)*

Unfortunately I think there's a problem in the principle of operation of your idea John. As far as I know, the speed of sound is determined by two main factors: the type of medium it's travelling through, and the temperature of the medium. Turbulence or motion in the medium has no effect.

Temperature is certainly a factor, as many people would have experienced. The speed of sound in air is 331.29 metres per second at 0°C, but because sound waves propagate faster in warm air, they travel faster closer to the Earth. The higher velocity of sound in warmer air near the ground creates what's called 'Huygens' wavelets' that also spread faster near the ground. Because a sound wave propagates in a direction perpendicular to the wave front formed by all the Huygens' wavelets, sound under these conditions tends to refract upward and become 'lost'. The sound of thunder created by lightning can be refracted upward so strongly that a shadow region is created in which lightning is visible but the resulting thunder is silent.

Sound velocity in water is determined by the square root of elasticity divided by the water's density. Because water is only slightly compressible, it has a large value of elasticity and therefore conducts sound rapidly. Since both the elasticity and density of seawater change with temperature, salinity and pressure, so does the velocity of sound.

In our oceans the speed of sound varies between 1,450 and 1,570 metres per second, increasing by about 4.5 metres per second for each degree Celsius increase. Increasing salinity increases the velocity, as does an increase in pressure, at the rate of about 1.7 metres per second for an increase in pressure of 10 bars or so, which is around 100 metres in depth.

Regarding an ultrasonic anemometer, I could find nothing about such a device, although there are certainly a number of different types of anemometers. The best known is the revolving-cup electric anemometer, in which the revolving cups drive an electric generator connected to a meter that's calibrated in wind speed. The useful range of this device is from five to 100 knots. Other types include the pressure anemometer (which has a pitot tube), a hot wire type, and various anemometers with some sort of rotating device driven by the wind. But a sonic type? If anyone can help out on this device, please let me know.

Staying with the concept of velocity, here's a letter that suggests communication might well be possible at speeds faster than that of light...

Brain waves

> *Is it possible that we are wasting our efforts in the way we are trying to receive transmission from intelligent life in space? Intelligent life might be the human race, years into the future. Given that we learned to communicate at the speed of sound and, more lately, at the speed of light, then why not transmissions faster than the speed of light?*
>
> *If we progress to that point, presumably we could both transmit and receive – that is, receive transmissions from a time yet to 'occur'. Now, wouldn't that be a fundamental change to the nature of man! But do we know of any particle, or non-particle, that can travel at these speeds? I think it probably does exist – the clue to its form may well be found on your shoulders. (Stephen Butcher, Masterton, NZ)*

I was intrigued some time ago by a TV program that dealt in a simplistic way with quantum physics. The show described an experiment which proved "beyond doubt" that the behaviour of a particle (I forget which type) was influenced by another particle, with communication between particles apparently occurring instantaneously. That is, at a speed well beyond that of light.

So Stephen, perhaps you're right. There might well be a means of communication that doesn't require any time to elapse between receiver and transmitter. Just what form it might take is anyone's guess, but it's an exciting concept, and one I'd love to witness if it's discovered in my life time.

What's happened to EA?

Change is always a challenge, and I guess the following letter might ring a few bells with our regular readers, following the recent changes made to the magazine's format, and name.

> *I have been a regular reader of EA for nearly 35 years, and I don't recognise it anymore. What's going on? It seems gloss and colour are more important than anything else; I even have difficulty finding where your column is in the magazine. To me, a technical magazine doesn't need lots of pretty pictures or fancy design, it needs content that is technically relevant and easy to find. It should also have more projects and the type size should be larger. After all I'm now pushing 80, and my eyesight is not what it used to be. Are all these changes due to your new editor? I preferred the way it was when Jim Rowe was in charge.* (Warwick Moriarty, Padstow, NSW)

The magazine business is not what it used to be Warwick. These days we are up against the internet and other sources of information. As well, statistics have shown that magazine readership in Australia has been steadily declining over the last 10 years or so. We have a loyal readership, but unfortunately one that has an average age much higher than most magazines. To stay in business, we need to attract more readers from a younger age group.

To achieve this we need to ensure *EA* looks the part. It's a very visual world these days, and maintaining a layout and design that has its roots in the 1960s is not a way of attracting new readers. But, design aspects aside, I agree that content is most important. There have been a few complaints about the reduction in the number of projects, but this has nothing to do with the new design. It's simply a fact of life: some issues have more projects than others. We don't intend cutting back on projects as we see these as an essential part of the magazine.

Regarding type size, you might notice that the quality of the paper is now much higher, giving sharper print and better reproduction of photos. I too need fairly strong glasses these days, and yet I find the print size ok. True it's down a point size or so to what it was, but it's still perfectly readable, and pretty much the same size as that used in most newspapers. Furthermore, the content has not changed, although some contributors are no longer with us, due to all sorts of reasons.

The changes have nothing to do with *EA* staff by the way. We are simply a part of a larger organistion that needs to keep all its magazines profitable. The new design has been done in consultation with our staff, but was not driven by us.

However, we all feel the results are going to pay off, and that we can look forward to producing the magazine for many years to come. But without the changes, we could have been out of business in a year or so. Still, reader comments about this are important to us as we don't want to alienate our existing readership.

Second phone line

I've had a few letters in response to the discussion in May about Telstra's 'black box' technology that provides two phones over one pair of copper lines. But as the following letter describes, there's another older system used by Telstra, called a pair gain system, that according to our reader is not all it's cracked up to be.

> *I read with interest your article about Telstra offering a second line using a 'black box' for $75, which I assume is a pair gain system. I had one of these black boxes installed about a year ago. Previously, with the single line, I was regularly getting a typical connection speed of between 48k-56k. Now all I get is a rock solid 26.4k, no higher and no less. The pair gain system was installed because there were no spare pairs from my house back to the telephone exchange.*
>
> *At the time I was promised there would be no perceived reduction in the grade of service to my home. I should also add that when using the normal telephone there is an annoying background hiss which is always present on the line. Progress? (Ian Anderson, email)*

I recently had an enquiry about the black box system mentioned in May from a reader who was having difficulty convincing the Telstra representative he spoke to that the technology is in fact available. However, after much phoning around he found out the following:

> *I have now delved further and questioned Telstra at length, and they still denied all knowledge of the $75 deal. After a lot of calls, I finally talked to someone who knew, and the 'black box' (beige actually) is called an ANT1 (Analog NT1). It's a derivative of the OnRamp ISDN service and was originally designed to get Telstra out of the smelly stuff when they couldn't supply more copper to a location requiring two phone lines.*
>
> *It gives the equivalent of two simultaneous copper pairs over one pair, but unlike the pair gain system, it offers no degradation of data rates, and in fact can actually offer better rates due to the ISDN quality. However there's one condition, you can't be more than 4.5km by cable from your nearest exchange!* (Tim Stockman, email)

I'm interested in hearing again from you Tim, or from any readers who have this 'beige box', to learn how it performs. However, whether it's excellent or not, it still assumes one copper line which as I experienced recently, can be a real limitation.

My new phone line had become extremely noisy, to such an extent that I could not use it for any on-line purposes.

I got around this by swapping the modem to the other line, which was not exhibiting noise problems. Any form of line sharing would not have given me this option. I should point out though that Telstra fixed the problem the day after I lodged a complaint.

5 channel mixer

Audio type projects are always popular with readers, but can we help with this next request? Surely we can...

> *I'm new to electronics, and I wonder if you can help me with a query about a project you might have published. I'm want to build a five channel audio mixer (three mics, two line), and was wondering if EA has ever published a balanced microphone preamplifier. If not, are you considering one in the future?* (David Elsbury, Auckland, NZ)

I spoke to our resident audio expert Rob Evans who suggested the Multi-purpose Preamp Board project published in November 1988 (page 64). This project lets you build up virtually any type of preamp, balanced or unbalanced, mic or line input, tone control etc. However you would need a few boards, interconnected as required

continued on page 97

TO STAY IN BUSINESS, WE NEED TO ATTRACT MORE YOUNGER READERS...

DARREN YATES

Transistors – 1

This month, Darren begins a new series looking at how transistors work.

If ever there was an electronic component to change the course of history, it would have to be the transistor. This three-legged device first created in 1948 took the world by storm with its low power consumption and tiny physical size.

It was a breakthrough of epic proportions – you have to remember that back in those days, the only amplifying device around was the valve (or 'tube' as the Yanks called them).

Valves were bulky and required significant amounts of power just to heat up the filaments -- and that's before you even started doing anything serious.

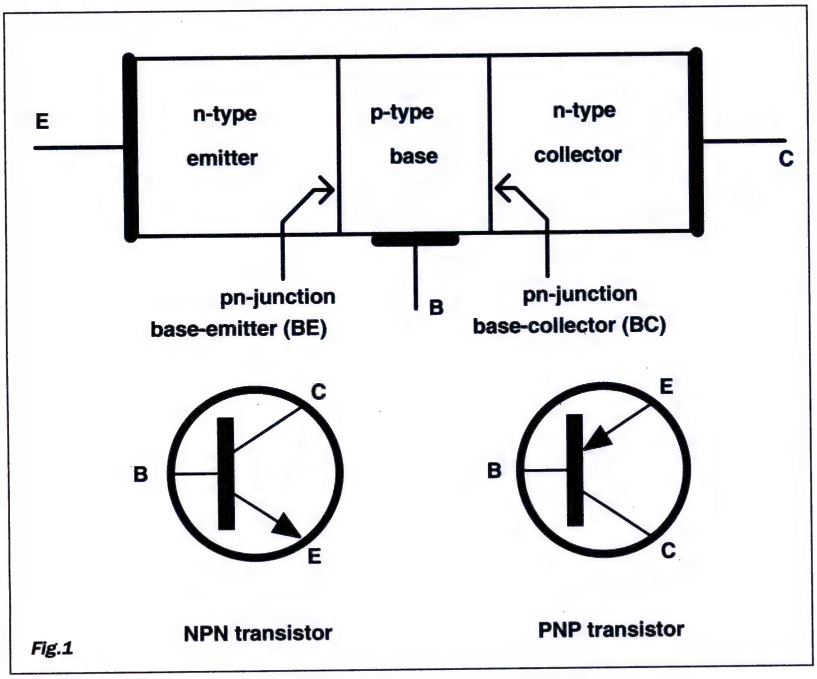


Fig.1

The idea that what previously required lots of space and power could now be achieved by a tiny package smaller than your fingernail was nothing short of mind-boggling.

Millions of transistors can now be found in every personal computer – in fact, without them, the personal computer revolution would never have got off the ground.

When you hear the word 'transistor', it's generally associated with the most common type known as the bipolar junction transistor or BJT.

Today, there are two types of BJT, and they're known as NPN and PNP.

OK, lots of three-letter acronyms make for confusion so let's get a look at Fig.1 to see what this is all about.

Fig.1 shows a very basic block diagram of how an NPN transistor works. You can see there are three basic regions – the n-type emitter, the p-type base and the n-type collector. There are also two 'pn' junctions – the base-emitter and the base-collector.

Each of the three regions has a terminal connected to it; they're the ones we use to connect them into our circuits. Hopefully, you can see too that a PNP transistor is almost the same except that the region types are swapped.

Now transistors are pretty clever little devices – not only can they amplify a small signal but they can also be used as a controllable switch (it's this feature that makes computers possible).It all comes back to those two PN junctions we talked about a few seconds ago.

Transistors have three modes of operation known as 'cutoff', 'active' and 'saturation'.

Which mode it operates in depends on how the junctions are 'biased'. If we think back to the good old diode for a second, we know that we must have 0.6V more on the anode than the cathode of a diode for a current to flow from the anode to cathode.

We say the diode in this situation is 'forward biased'. If the voltages were the other way around, that is, the cathode at a higher voltage than the anode, we'd say the diode was 'reverse biased '.

OK, back to our transistor.

Regardless of whether it is a PNP or NPN type, a transistor is in cutoff mode if both the base-emitter (BE) and base-collector (BC) junctions are reversed biased. It's in the active region if the BE junction is forward-biased and the BC junction reverse-biased and the device is saturated if both junctions are forward-biased.

Notice the arrows in the schematic symbols? You can think of these as the direction of conventional current flow. In fact, we mentioned the diode above for the very good reason that the base-emitter junction acts just like a diode – a fact exploited in one of the very first circuits: an amplified crystal radio.

Putting it very simply, in order to switch on an NPN transistor, the base needs to be 0.6V above the emitter. To switch on a PNP transistor, the base must be 0.6V below the emitter.

MILLIONS OF TRANSISTORS ARE IN EVERY PC ... WITHOUT THEM THE PC REVOLUTION

This might seem like a lot of theory but really, it's nothing compared to what you need to know for some of the more specialised uses of these things.

Simple circuit

OK, this is as simple as it gets. It's not very useful for anything but it gives us a good glimpse at how these devices work. Fig.2 shows us a 9V battery, two resistors and a transistor.

Arguably the most important parameter of a transistor is its amplification factor or 'beta '. It varies quite widely from a few tens for large power devices to many thousands for smaller devices.

There are many other parameters that determine how a transistor works and how you can use them – if you have a Dick Smith Electronics catalog, you'll find plenty of that data in the back. We'll leave the issue of transistor data for next time.

Our transistor here is the imaginary EWE01 and it has a beta of 100. Knowing the beta plus the other component values, we can work out exactly what's going on with this circuit.

To start with, current flows from the battery, through the 100k resistor connected to the base pin (I'll refer to this as the 'base resistor' from now on), through the base-emitter junction and back to the battery.

Since we know the value of the base resistor, we also know that the current flowing through the base-emitter junction is:

Ibe = (9V - 0.6V)/100k (Supply voltage minus BE junction drop, all divided by the base resistor) = 0.000084 amps or 84uA

From this we can work out the current flow through the 1k collector resistor:

Ic = Ibe x beta, = 0.000084 x 100, = 0.0084 amps or 8.4mA

And this current flows from the battery, through the 1k collector resistor, through the collector and emitter of the transistor and back to battery-negative.

The voltage at the collector is therefore:

Vc = Vbattery - (Ic x Rc) = 9 volts - (8.4mA x 1000 ohms) = 0.6V

Hopefully, you can see that this transistor is in the active region (just) - the BE junction is forward biased and the BC junction is reverse-biased, although with the collector only 0.6V above ground, it's not the ideal operating point for an amplifier circuit.

You should also notice that this circuit is heavily reliant on the transistor beta to determine the amplification or gain – that's not an ideal situation because every transistor has a different beta, even two of the same batch.

Fig. 2

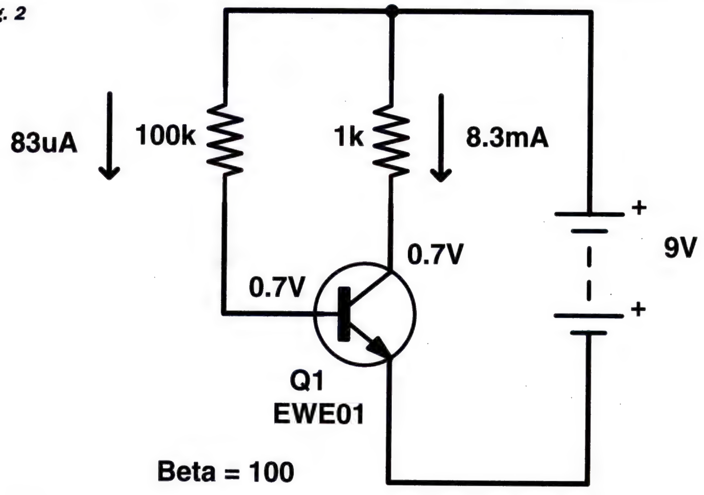


Fig.3 shows a slightly more complex circuit and what we're going to do is to again work out the DC voltages and currents.

Looking at the circuit, we know that the base voltage is 2.8V so the voltage at the emitter is going to be 2.8 - 0.6V = 2.2V. The emitter resistor is 2.2k so the emitter current will be 2.2V/2.2k = 1mA.

What we haven't said until now is that the emitter current is the sum of the base-emitter junction current and the collector-emitter current. Given that our transistor has a beta of 100 we know that the base current is 1mA/100 = 10uA. That means the collector current has to be 1mA - 10uA = 0.99mA.

From this, we can deduce that the voltage at the collector is 9V - (0.99mA x 4.7k) = 4.347V if you do the maths. In practice, it will most likely hover somewhere between 4.2 and 4.5V depending on component tolerances.

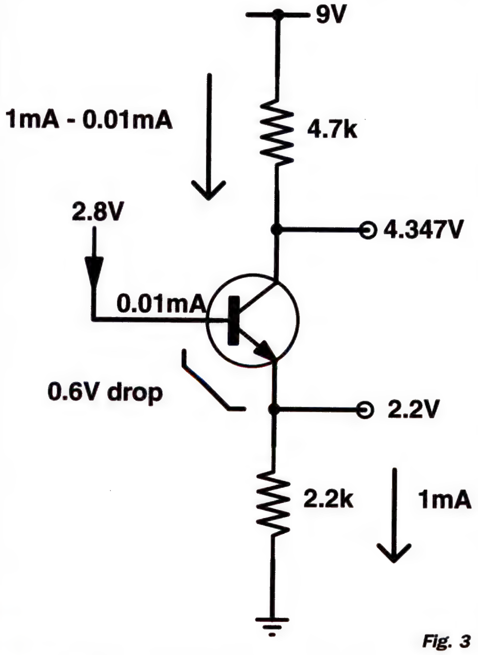


Fig. 3

WOULD NEVER HAVE GOT OFF THE GROUND.

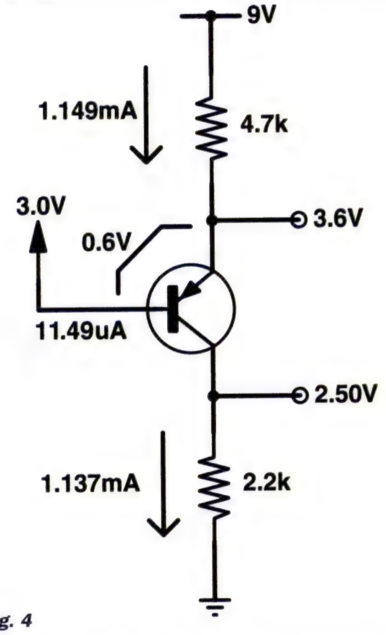


Fig. 4

With most of these simple circuits, it's fine to be within +/-10%. Although not as forgiving as valves used to be, transistors will still work in circuits over a fairly wide range of tolerances.

PNP analysis

So far, we've only dealt with NPN transistors so let's do that last DC analysis circuit again, this time with a PNP transistor instead. We'll call this transistor EWE02 and it also has a beta of 100.

Looking at the circuit in Fig.4, we know the base voltage is 3.0V so the emitter voltage is going to be 0.6V above that (remember the forward drop of the BE junction), which is 3.6V. The current flowing through that 4.7k emitter resistor is (9V - 3.6V) /4.7k = 1.149mA. The base-emitter current (flowing from emitter to base this time) is 1.149mA/beta = 11.49uA.

From this, we can figure that the collector current is 1.149mA - 11.49uA = (approx.) 1.137mA, and so the voltage at the collector of our transistor is 2.2k x 1.137mA = (approx.) 2.50V.

Go through these last two circuits a few times until you get the hang of it.

Phase relationship

While it may not have been obvious, you may have seen that the emitter voltage follows the direction of the base voltage, that is, raise or lower the base voltage and the emitter voltage follows it - we call this being 'in phase '.

However, if we raise the base voltage, the collector voltage drops and vice versa. We say the collector voltage is 'out of phase ' with the base voltage. As an example, take another look at Fig.3 again but this time, instead of a base voltage of 2.8V, substitute 2.5V and 3.3V and redo the calculations and you see this relationship between the three terminals.

This is an important lesson to remember and one you'll use time and time again.

Three basic amplifiers

Now that we've looked at the basics of the transistor, let's look at some simple amplifier circuits. The first one is the known as the common-emitter amplifier shown in Fig.5. The input signal is applied to the base via a coupling capacitor and the amplified output is taken from the collector via another coupling capacitor. The reason for these capacitors is so that the preceding and following stages connected to this circuit don't cause any changes to the DC operating conditions.

This circuit is known for its good voltage gain and reasonable power gain. By 'power gain ', I mean its ability to turn a weak (high impedance) signal into a low-impedance signal.

This circuit is the best way to implement a one-transistor amplifier that is stable, reliable and most importantly, virtually transistor-beta independent.

While it's difficult to see straight off and without a couple of pages of theory, the gain of this stage is basically equal to the collector load

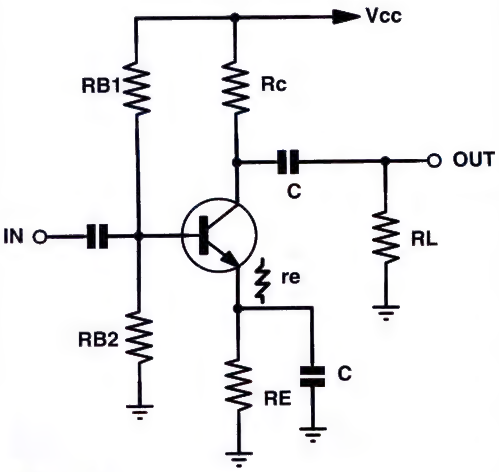
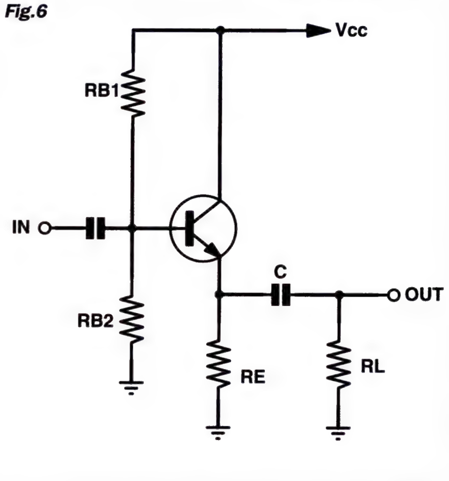


Fig.5

Fig.6



divided by the emitter load.

Notice here that we have a comparatively large capacitor across the emitter resistor. In this situation, the emitter resistor is by-passed and has no effect on the AC signal but rather than no emitter resistance whatsoever, the base-emitter junction of the transistor itself has a small amount of resistance known as 're'.

This emitter resistance is: re = Vt/Ie, where Vt = 25mV and Ie is the DC emitter current.

The gain of the circuit is then effectively: Gain = Rc/re

Also take note that the output signal is out-of-phase with the input.

The circuit in Fig.6 is the common-collector or 'emitter follower '. Here, the signal output is taken from the emitter rather than the collector. It offers no voltage gain whatsoever however it has very good power gain. It also has a very high input impedance which effectively equals the total emitter resistance times the transistor beta.

It means we can connect up a high impedance signal to a low-impedance load without any significant loss of signal. The output signal is also in phase with the input.

The last circuit in Fig.7 is known as the common-base amplifier and is the least common of the three. Although it can be used for audio amplification, it is most often used for radio frequency work.

It's a little unusual in that the base is connected to ground via a capacitor and the input signal is fed into the emitter instead. However if you look carefully, it's little more than a common-emitter amplifier on its side.

Like most devices, transistors run into problems when it comes to amplifying high frequencies. One cause of these problems is known as Miller capacitance, an internal parasitic capacitance that progressively reduces the transistor's ability to amplify high frequency signals. The common-base circuit negates this capacitance by grounding the base pin.

The problem with it though is that it provides reasonable voltage gain but at the expense of power gain, meaning that it has a low input impedance and a high output impedance, which limits what you can connect to it. The output is also in phase with the input.

What? That's it?

Well, we've tip-toed around some of the basic theory of transistors, which is as much as I can hope to do in a couple of pages. I could point you to a number of fairly good reference books but I reckon there's no better place to learn than in the school of experience – you'll learn much more by doing than you'll learn by reading.

While I graduated in electronics at university level, I easily learned as much again in the field by getting my hands dirty and making a few mistakes along the way.

Another tip that really helps is look at as many circuits as you can find – even build as many of them as you think necessary. Not every circuit you'll find will work perfectly; some may not even work at all but the more you build, the more you will learn.

Next month, we're going to look at the area of datasheets, how to read them, what all that data means and how it affects your circuit design. See you then. ■

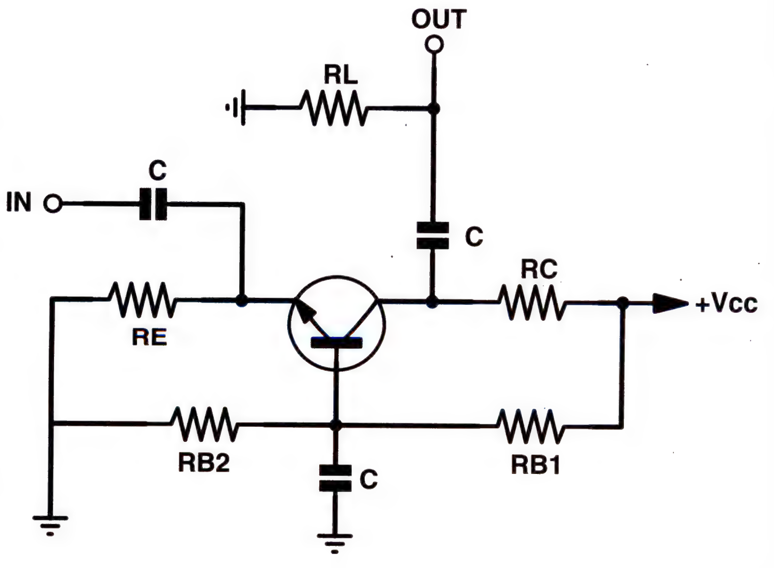


Fig.7

VINTAGE **RADIO**

BY ROGER JOHNSON

Restoring a crystal set, & their **place in history**

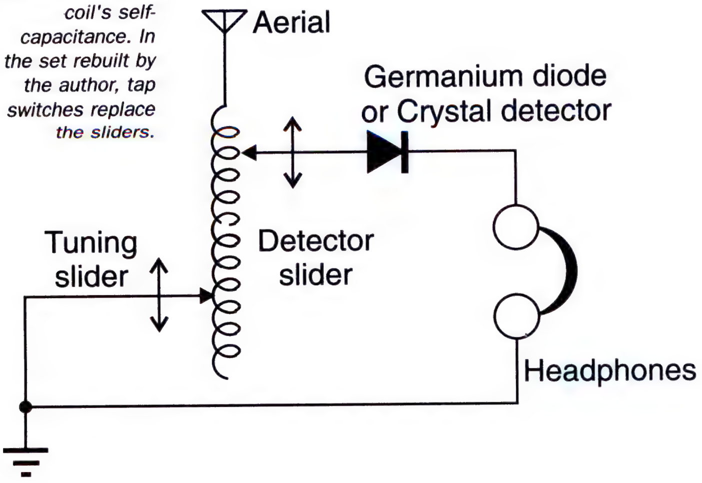
This month's story concerns one of the simplest of all radios -- a crystal set, and its a crystal set with one of the simplest circuits possible at that. But the simplicity starts and finishes with the circuit.

CRYSTAL SETS are almost a sub-culture amongst radio and vintage radio enthusiasts, and some very elaborate designs have been proffered by members of various crystal set societies. But these sets are far more than just a curio and a challenging pastime, despite what many people may think. In fact crystal sets have had three important roles in the long history of radio.

Firstly, crystal set radio pre-dates just about any valve radio. ('Crystal set' in this context refers to radio without valves.) Detection may not have necessarily been by a lump of galena and a length of spring steel wire. Some very VERY early types may have used a Marconi magnetic detector or a carborundum detector.

For example the 'Mark III' tuner of World War I was actually a very elaborate crystal set with provision for a variety of detectors, including a diode valve, and could drive a sensitive loudspeaker.

Secondly, a crystal set was the answer for those who couldn't, or wouldn't, purchase a valve radio in the 1920s. A crystal set was seen as a serious answer for budget priced radio. The fact that usually only one person could listen to it at any time seemed of no great importance then.



The deceptively *simple circuit for a 'slider tuned' crystal set, which makes use of the coil's self-capacitance. In the set rebuilt by the author, tap switches replace the sliders.*

Thirdly, a crystal set was almost universal as a 'first step' in fostering a budding interest in radio, for a young lad or girl. When valve radios were still out of reach for a youngster's budget, a crystal set was often the only answer. Just about every lad with a mechanical or curious bent built a crystal set, whether they went on to develop a career in electronics or not.

Crystal sets were probably built right up to about 1960 or perhaps beyond. Some were sold commercially as a complete unit, particularly by the 'Aegis' brand, and from the 1950s a germanium diode tended to supersede the old lump of galena and cat's whisker wire.

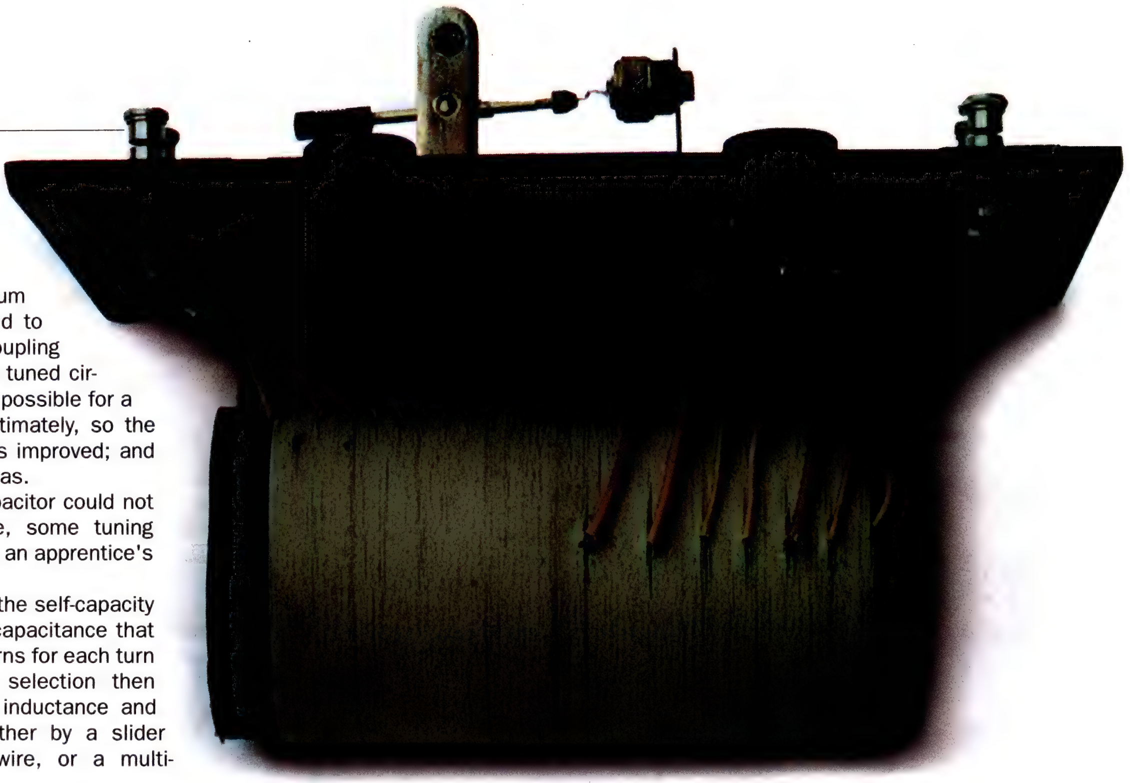
Limitations

Some elaborate and sensitive crystal set designs have been developed over the years, and some of them will actually separate the local stations! (Refer *EA* for June 1988: the 'Deluxe Crystal Radio'). Sets like this often rely upon today's vastly increased signal strengths, which allow bandpass tuning to greatly enhance selectivity.

But in the early 1920s and the mid 1920s in particular, crystal set design was not so eloquent. Firstly, the 'B' class, or commercial radio stations were limited to only 500 watts power. The 'A' class stations, i.e., those which derived their revenue from licence fees and which ultimately went on to become the ABC, had transmitter power from 3kW to 5kW. As there were only two stations in all cities except Sydney, selectivity was not a problem unless one resided close to the B class transmitter. As a result, very simple crystal sets were practical and the order of the day.

Basic tuning

Many, many crystal sets comprised little more than a coil and variable capacitor forming a tuned circuit. The coil often had taps at every 10 or so turns on a total of 60, such that the aerial and the detector could independently be selectively coupled to the tuned circuit.



The author's *coil for his switch-tuned set.*

This was to facilitate optimum antenna coupling as an aid to selectivity, and optimum coupling of the detector so that the tuned circuit was loaded as little as possible for a given reception locality. Ultimately, so the theory goes, selectivity was improved; and in many circumstances it was.

But what if a tuning capacitor could not be afforded? At the time, some tuning capacitors cost as much as an apprentice's weekly wage!

The answer was to use the self-capacity of the coil, i.e. the small capacitance that exists between adjacent turns for each turn of the coil. The station selection then depended on varying the inductance and capacitance combined, either by a slider contact over enamelled wire, or a multi-tapped selection switch.

The circuit of such a device is abidingly simple, and is shown in Fig.1. One slider selects the coupling for the crystal detector, and the other varies the length of the coil, and hence the inductance and capacitance (combined).

Such a scheme also has another advantage. The 'Q' of such a coil is quite high, and it is a high-L/low-C circuit. This will increase the voltage developed across the coil at resonance, such that the detector can be tapped lower 'down' the coil and reduce the loading – which will enhance selectivity.

A lost cause?

The little radio shown in Fig.3 was the topic of much discussion between its intended owner and the author. It originally purported to be a valve radio, but an ungainly three-coil tuner, the small cabinet as well as the series of vacant holes behind the control knobs suggested otherwise.

Further investigation showed that the three-coil tuner had been fitted where a crystal detector had once been, and the little labels were actually crystal set labels. There were two binding posts, no doubt for the filament battery, which were of a different style to those at the top of the panel.

Inside was an enormous 23-plate tuning capacitor, a dud Philips type A110 (1925) valve, and a grid leak and grid capacitor strung together in a fairly untidy manner.

My guess was that this radio started life as a crystal set and perhaps together with an old valve and some bits and pieces was given to a novice, perhaps 10 years later, for him to build a valve radio. The new owner presumably thought that it would be nice to go that one step further and 'upgrade' the crystal set.

Originally, there were only two controls, and behind each control was an arrangement of holes around the circumference of a circle. So the only possibility was for a switch-tuned receiver in which the taps replaced a continuously variable slider.

Another factor which affected slider-tuned sets was that they had to rely on a coil of enamelled wire, and not cotton-covered wire. The enamelled wire tended to be of a fairly hefty gauge, as thick as 20 SWG. The thicker wire was chosen to prevent short circuiting of one or many adjacent turns by the slider contact.

As a result of the thicker wire, the number of turns to the inch was reduced to about 30 turns. This meant a large diameter former – often 5" (125mm) and containing up to 300 turns, with a length of about 10" (250mm). That is why those very early slider-tuned crystal sets had such enormous coils.

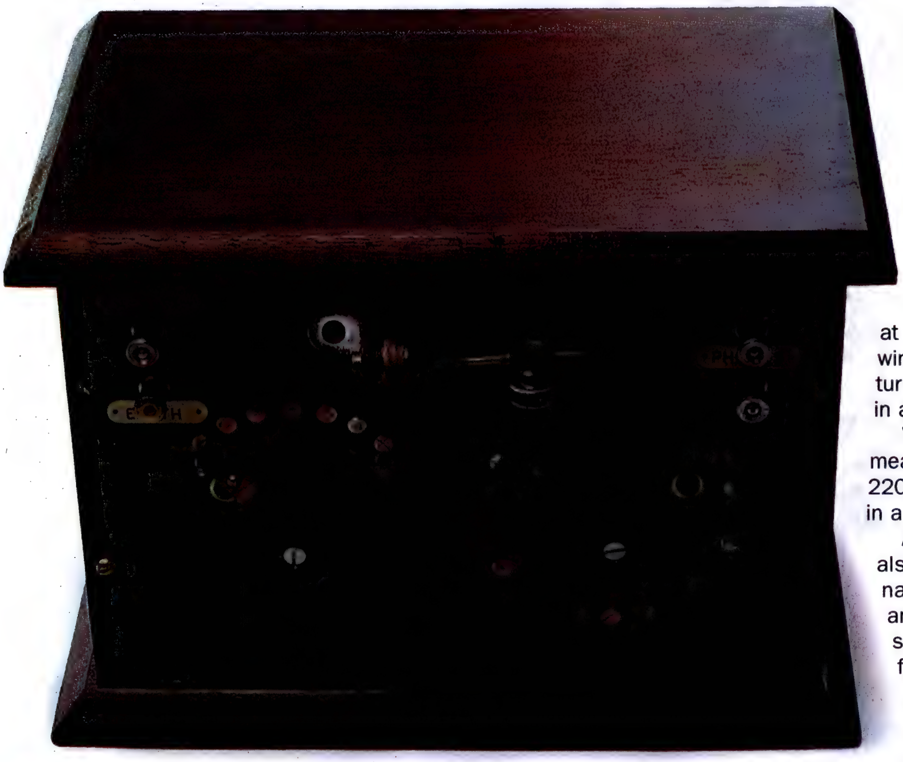
On the evidence available, this particular crystal set had only two controls and these were both stud switches. (The Americans prefer to call them 'tap switches'.) Therefore, there was no tuning capacitor. However the cabinet simply did not allow for a 5" diameter, 10" long coil former. So in this case the coil was most likely a 3" former, and allowing for end space, no more than 6" in length. It was also enclosed in the small cabinet, making access to sliders somewhat difficult. Everything points to a switch-tuned coil wound with medium to fine gauge wire, and in keeping with the day, the wire would have most likely been cotton covered.

The holes for the studs were all over the place, but they seemed to be in arcs of 1-1/2" (38mm) radius. One switch was obviously for the 'earth' end, which altered the tuning parameters. The other switch was by implication for positioning the tap for the crystal detector.

A big, long coil

At this stage I decided that speculation must give way to design and construction – or reconstruction, if you prefer.

To contemplate winding a coil for this receiver, the constraints of space had to enter the equation as already mentioned. Fortunately, a very enterprising person has devised a coil winding chart, which is a sort of ready reckoner for coils: a series of parallel and graduated line-graphs. The first is for capacitance, the second for frequency, the third for inductance. Then there are a series of four other graphs



The completed *switch-tuned crystal receiver. As acquired it had been converted into a one-valve set, so restoration required some sleuthing and 'unconversion' – as well as coil design and winding.*

giving coil diameter, turns-per-inch (i.e., wire gauge), number of turns and overall coil length. Unfortunately, multiplying the turns per inch by the length of the coil does not give the total turns! (There may have been a printer's error in which one of the line-graphs was misplaced a fraction of an inch).

First of all we need to select the capacitance. Now with a variable capacitor, you would select its maximum capacitance. However, for this purpose, the self-capacitance of the coil was assumed to have a value of 30pF to tune a frequency of 550kHz.

With a fine pencil and ruler, you join the capacitance graph to the frequency graph and read the inductance – in this case, 2500uH (or 2.5mH).

Next you extend the inductance graph to the coil diameter (3") and this line intersects a 'base line'. You then select the turns-per-inch. You connect this selection back through the base line point referred to before, and then read off the total turns and coil length.

In this case, some 30 SWG DCC (double cotton covered) wire was to hand, which meant 55 turns per inch for the sake of calculation. The result was 300 turns, or thereabouts, close wound, resulting in a coil almost 5" in length.

The same exercise was repeated to determine the top end. It was assumed that for 1.5MHz, the capacity would be about half, so the tap for the top of the coil would be at about 150 or so turns. In fact, it was chosen to be about 120 turns.

As the original front panel had split and a new one would need to be cut, there would be the opportunity to change the number of switch and tapping positions. As a result the number of tuning taps was changed to 17, because it is easier to arrange an odd number of taps in a symmetrical manner. There were a total of seven detector taps, again an odd number.

Calculating the taps was guesswork relying upon experience. For the tuning taps, there are four intervals of 5 turns, four intervals of 7 to 8 turns, four intervals of 10 turns and four intervals of 20 turns, approximately. All of those figures do not add up to exactly 300 turns, but no matter.

The coil former was marked out and drilled at the required distances from the start of the winding. The detector taps were placed at about 20 turn intervals from the top of the coil, marked out in a similar manner.

When completed, the coil's total inductance was measured on a digital meter and came out at 2200uH. Something went right! The small difference in a coil of this size is negligible.

As well as being split, the original front panel also had too many holes in it that were not original. It had been made of thin but solid timber, and painted black. A new piece of similar thin solid timber was selected, and duly marked out for the switch studs.

Then it was into the spares department to see how many brass switch studs could be unearthed. By salvaging another old and derelict panel, 24 studs and their stoppers were unearthed, and they all cleaned up a treat. I also turned up a genuine crystal detector, with a lump of galena and the swivel arm. These items were all duly cleaned up and polished.

Assembly & results

In the first instance, the coil was lashed together on the workbench using test leads dangling in all directions. The outside antenna was connected (if you can call 10 to 12 feet of hookup wire thrown over a bush an antenna), together with a germanium diode and a pair of headphones.

It worked! Not only that, but two stations could be separated out from a quite powerful local transmitter. The assumptions made for the coil were obviously not too far out...

Better still, when the cat's whisker detector was hooked up that worked as well – although the germanium diode does give a slightly louder signal.

By inserting a small capacitor in series with the antenna, slightly better results again were obtained, and a further small improvement was obtained by connecting a 1nF capacitor across the phone terminals. These components were not in the original design, but can be added externally to improve results.

The end result is most gratifying. Scrounging around for parts, particularly the tap switch assemblies was no mean task.

So too was calculating the coil, winding it, and marking out the switch holes with a template after first using a protractor and a piece of paper. The design is so simple, yet restoring it required skills significantly different from valve radio.

All in all, it was a very satisfying project. If you get a chance to tackle a crystal set restoration yourself, I can recommend it! ■

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BY OWEN BISHOP

Reversing motor drive

Want to get a model car or truck driving around by itself? Add this little project, and you can have your vehicle driving forwards and backwards in no time. It can automatically switch from forwards to reverse and back again, or you can have it respond to different light levels. Either way, this is a simple (and cheap!) way to bring your model alive...

PARTS LIST

resistors	
R1	10 k
R2	560 k
R3	light-dependent resistor (ORP12 or similar)
VR1	100Ω trimpot
capacitors	
C1	10uF electrolytic
semiconductors	
IC1	555 timer
Q1	BC548 transistor
miscellaneous	
RLA1	Mini DIL PCB relay with 5V DC coil, 1A contacts
DC motor, stripboard 17 x 80mm (6 strips x 31 holes), 10 x 1mm terminal pins, 8-pin IC socket, 2 x crocodile clips or switches, 4 x battery holder.	

***It's simple**, and quite effective. A 555 with a couple of other components can make your model come alive...*

THIS CIRCUIT was originally designed for a model steamroller toy, but it has many other applications. It provides the drive current for a small DC motor with two modes of operation.

1: Automatic; the current reverses automatically every four seconds. You can adapt it to make the periods longer or shorter if you want.

2: Light level controlled; the current reverses depending on whether the vehicle is in a relatively bright situation or in dim light. You can set the light level at which reversal occurs.

The circuits for the two options are quite separate so, if you decide that you do not want one of the options, you can save costs by leaving it out.

Automatic action is ideal for the steam roller application. The roller runs backward and forward indefinitely, reversing every four seconds. A similar action can be set up if you arrange for the floor to be brightly lighted in one area and shaded in another. The roller runs back and forth, alternating between the light and dark areas. If you direct a torch beam or laser pen at it, the model can be made to reverse whenever you catch it in the beam or allow it to escape.

This circuit can also be used for powering other toy vehicles, such as model locomotives, tanks and tractors. Make the model yourself, using stiff card or polystyrene sheet, or adapt a ready-made toy for the purpose. Since the circuit can switch motors powered on any DC voltage from 1.5V upward, it can also be used in conjunction with existing model railways and other toys.

There is also the possibility of using the circuit to drive static toys, such as a model carousel or roundabout. Alternatively, it can drive a mobile Christmas decoration, or a shop window display. It all depends on your inventiveness and model-building skills.

How it works

The reversing action of Mode 1 is provided by a relay with double-pole double-throw (DPDT) contacts. When wired as in Fig.1, the direction of current through the motor depends on whether or not the relay coil is energised. The automatic reversal of Mode 1 makes use of a 555 timer (IC1) wired as an astable. The timing depends on the values of R1, R2 and C1:

The output is high (relay not energised) for:

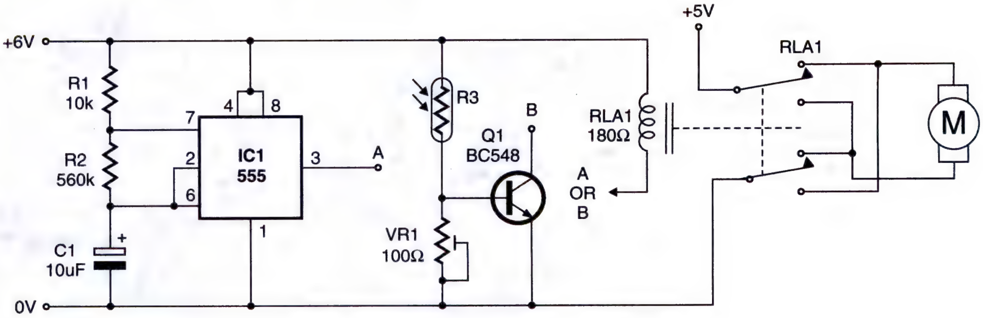
0.69 x (R1 + R2) x C1 seconds,

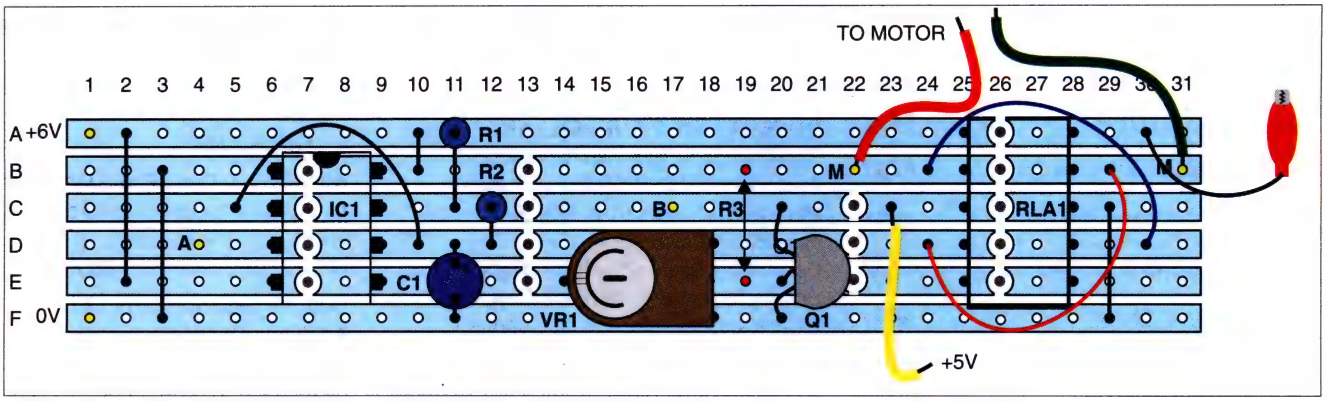
and the output is low (relay energised) for:

0.69 x R2 x C1 seconds.

In Fig.1, we have made R1 much smaller than R2, so the high and low periods are roughly equal. With the given values, the on and of periods are 3.93 and 3.86 seconds. The output of IC1 provides sufficient current to drive the relay directly.

For Mode 2, we use a simple light sensitive transistor switch circuit. R3 is a light-dependent resistor. In darkness or dim daylight, it has a resistance of several tens of kilohms so the voltage at the base of Q1 is less than 0.6V and Q1 is turned off. The coil of the relay is connected to the collector of Q1. With Q1 off, no current flows and the relay is not energised. In bright light, R3 has a resistance of only a few hundred ohms. The voltage at the base of Q1 rises above 0.6V, turning it

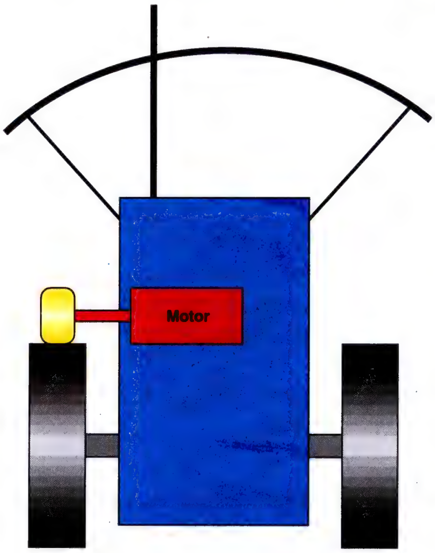




on. This causes current to flow through the relay coil, and the flow through the motor is reversed.

Note that the current for the motor is shown as coming from a separate 1.5V source, sharing its 0V line with the circuit. The motor used in the prototype runs on 1 - 6V so, to keep its speed down, we tapped off one cell of the four-cell battery to give 1.5V.

However, as the switching is by relay, we can use any suitable voltage instead of 1.5V, even voltages greater than 6V. If the motor is to run at 6V, the terminal labelled +1.5V can be connected to the 6V line of the circuit. If the two inputs to the relay contacts are made entirely separate from the main circuit (that is, leaving out the common 0V connection) we can use an AC supply to the motor. All voltages and currents must be within the maxima quoted for the relay contacts. There are some types of DC motor that turn in the same direction whatever the polarity of the supply current. Obviously, such motors are unsuitable for this project.



Construction

The first step is to decide on what materials are to be used for the model. Its dimensions must be chosen so that there is room to contain the battery holder, the circuit board and the motor. The location of R3 (if installed) and of switches must be decided on. To save costs, the mode selector switch can be a crocodile clip with two metal pins for it to be clipped to. A SPST switch of some kind is needed in the common 0V line to switch the power on or off. Switches are relatively expensive but can often be improvised from wire paper clips.

One of the most essential points to consider is the speed of the motor, which is typically several thousand RPM under no-load conditions. Usually, some form of reduction gearing is needed. Several electronics suppliers list plastic gearboxes, and some types of motor already have a built-in gearbox. Fig.2 shows how to improvise a reduction gear at no cost. The shaft of the motor carries a small rubber 'wheel'. Push a rubber stopper or similar cylindrical object on to the shaft. We used a small rubber grommet for this purpose. The small 'wheel' makes contact with a much larger wheel, which then rotates more slowly than the motor shaft. In a model roller or tractor, the larger wheel is one of the driving wheels of the vehicle.

Again, these can be improvised. A plastic cap from a large jar of Vegemite makes an excellent wheel, and its ribbed rim helps it to grip the small rubber wheel and also the road surface. There is need for pressure to hold the small wheel in contact with the larger wheel. Often the simplest way of providing this is to mount the motor loosely so that the small wheel is partly supporting its weight. Then gravity provides the required force and there is no need for precision engineering.

If all else fails, judicious use of rubber bands is quite effective...

A simple circuit such as this presents no construction problems. Assemble the timing and relay circuits and connect the crocodile clip to pin A. Connect a meter or the motor to the terminal pins labelled 'M' and check that the current reverses regularly. If both the circuit and the motor are running on the same 6V supply, it is possible for voltage spikes from the motor to reset the timer irregularly. If this happens, try wiring a 10uF capacitor across the 0V and 6V lines near to the supply terminals of IC1. This should effectively decouple the interference.

The light sensitive circuit is also easy to build and set up. When the circuit is complete, connect the crocodile clip to pin B and switch on the power. Turn VR1 as far left as it will go and expose R3 to bright light. Then turn VR1 slowly right until you hear a faint click from the relay as Q1 turns on and the coil is energised. Listen again for the click as you cover R3 to turn Q1 off and de-energise the relay. ■

***Construction** is fairly straightforward – If you go for the light sensor option, connect the LDR between B19 and E19.*

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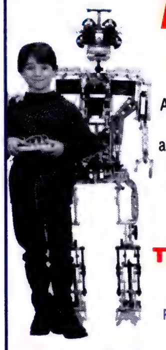

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INFORMATION CENTRE

The only other similar project was one presented in May-June 1983, a full-on eight channel, semi-professional mixer desk. Unfortunately kits of parts for both projects are probably no longer available, although the PCBs might still be available through RCS Radio. So perhaps it's time for us to look at another mixer type project.

What??

This month's question requires a degree of logic, and is based on a true situation. It was sent to me by Robert Bowman (Dereel, Vic), who says the problem continuaally confounds his friends. It goes like this:

My parents have been married for 35 years. However my 36 year old brother (no, he's not adopted) was born four years after they married. How can this be?

Answer to June

Marianne will be 29 as she watches the Y2K Olympics. If you got past the Irishness of the question, you could determine that Mary-Anne (born 1958) was 26 in 1984, 39 in 1997, 41 in 1991 and 42 in 2000. Again from the information in the question, Marianne was born 1971, she was 13 in 1984, 26 in 1997, making her 29 in 2000. ■

SERVICEMAN

My first reaction was to blame the modifications

I had made however any check I was able to make was spot on.

Finally I disconnected the main speaker and just left the eight inch mid-range in circuit. The distortion disappeared. The main speaker in the E10 is a huge, odd shaped, plastic skinned affair. It looked expensive...and was! In the end, I settled for a more conventional speaker with similar power handling capacity. It worked like a charm and the organ is now back in full service.

All this goes to show just how much trouble you can get into because a one dollar component was wrongly labelled.

All too true, Robert. As I recall, the October story told of the demise of a well designed and properly constructed stereo amplifier. Then there was a story once about errors in the silk-screening on a PCB which led to the ruin of every electro in the set!

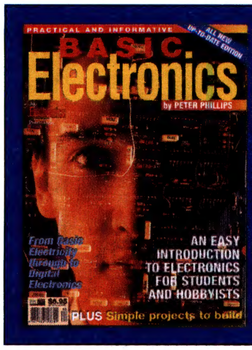
It seems that the poor old electro's bad press comes not only from it's own characteristic faults, but also from faults imposed on it through careless manufacture. It doesn't alter the fact that electros are the cause of more trouble than we can shake a stick at.

Thanks for that story Robert. As I've said before, it's good to hear about products other than TVs and videos. And that's it for this month. I'll be back next month with more stories from your bench, or mine. ■

ERRATA

- **2/4 Channel UHF Remote Control System (May 2000):** The schematic diagram on page 71 (Fig.1) incorrectly shows the lower end of R7, R8 and R9 connected to the circuit's 0V line (battery negative). They should in fact all connect to the base of Q2, as is the case for R6.

  The PCB pattern and component overlay diagrams are correct as published.
- **Circuit & Design Ideas (June 2000):** The schematic for the Clipping indicator circuit (page 68) shows transistor Q2 as a BC547 type. Being a PNP device like Q1, it should in fact be labeled as a BC557. Our thanks to the ever-vigilant Brad Sheargold for politely pointing out the error. ■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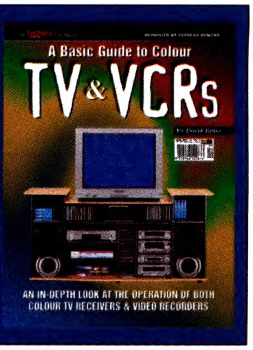
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WEB WATCH

BY DARREN YATES

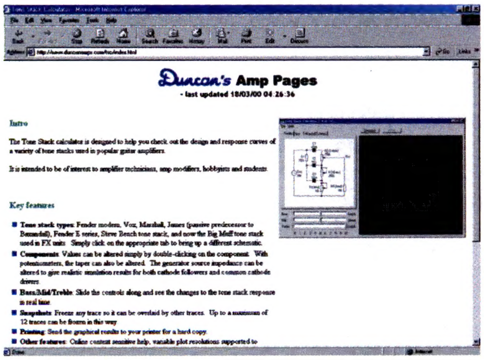
Valve sound and **rat routers**

ELECTRONIC HOBBYISTS are generally a pretty strange mob – some will be hell-bent on proving microprocessors can do everything; others will say bring back valves and let's hear some serious sound quality.

I lean more to the latter group (for which I make no apologies) and one software tool I have found to be a real hit is the ToneStack Simulator **www.duncanamps.com/tsc/index.html**. For those who don't know the lingo, a 'tone stack' is a passive tone control circuit that often incorporates bass, mid-range and treble controls as found in vintage guitars and amps.

This excellent piece of software allows you to change the values of components in a number of common tone stacks and actually shows you the frequency response as you move the controls. It runs on Windows 95 and a 486 computer.

IF YOU'RE LOOKING for more pages of circuits to add to your growing stockpile, there's more over at 4QD **www.4qd.co.uk/ccts/index.html**.
While the author retains copyright, there are plenty of interesting circuits here.



Duncan's Amp Pages

- last updated 18/03/00 04:26:36

Intro

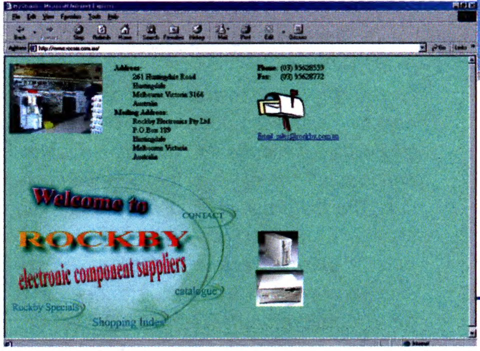
The Tone Stack calculator is designed to help you check out the design and response curves of a variety of tone stacks used in popular guitar amplifiers.

It is intended to be of interest to amplifier technicians, amp modifiers, hobbyists and students.

Key features

- **Tone stack types**: Fender modern, Vox, Marshall, James (passive predecessor to Baxandall), Fender E series, Steve Bench tone stack, and now the Big Muff tone stack used in FX units. Simply click on the appropriate tab to bring up a different schematic.
- **Components**: Values can be altered simply by double-clicking on the component. With potentiometers, the taper can also be altered. The generator source impedance can be altered to give realistic simulation results for both cathode followers and common cathode drivers.
- **Bass/Mid/Treble**: Slide the controls along and see the changes to the tone stack response in real time.
- **Snapshots**: Freeze any trace so it can be overlaid by other traces. Up to a maximum of 12 traces can be frozen in this way.
- **Printing**: Send the graphical results to your printer for a hard copy.
- **Other features**: Online context sensitive help, variable plot resolutions supported to

In fact, many of them are transistor-based so if you're following the *Experimenting With Electronics* series (shameless plug...), this is a perfect addition. Circuits cover everything from low-impedance audio microphone preamps to industrial process control circuits. Even if you're just a beginner, there's plenty here to sink your teeth into. This is the most interesting circuit archive I've seen to date and one to keep in your favourites folder.



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Melbourne Victoria
Australia

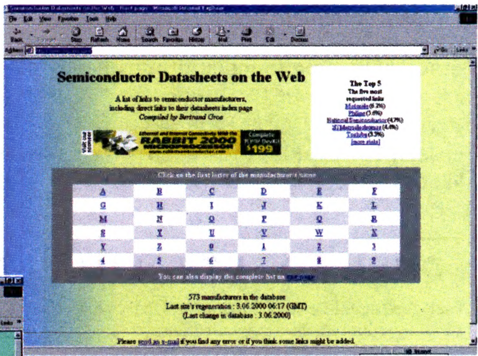
Phone: (03) 95628559
Fax: (03) 95628772

Email: sales@rockby.com.au

THERE'S NOTHING quite like designing your own circuits but unfortunately, without the right component specifications, it can be a real nightmare. In the old days, it meant keeping a book-shelf full of databooks from various manufacturers, which often took ages to look through to find exactly what you were after.

For better or worse, much of that information is now available on the Internet but rather than having to remember the web addresses for each individual manufacturer, you can now head over to Semiconductor Datasheets on the Web (**http://www.bgs.nu/sdw/**) and find the manufacturer of your choice.

That may not always help if you're after the maximum collector current for a BC549 transistor but it's a great place to start. Has lots of weird and wonderful makers but also the big names such as SGS-Thomson, Motorola and National Semiconductor. Another one for the favourites folder.



Semiconductor Datasheets on the Web

A list of links to semiconductor manufacturers,
including direct links to their datasheets index page
Compiled by Bertrand Gros

The Top 5
The five most requested links
Motorola (6.2%)
Philips (5.6%)
National Semiconductor (4.7%)
ST Microelectronics (4.4%)
Toshiba (3.3%)
[more stats]

Click on the first letter of the manufacturer's name

A	B	C	D	E	F
G	H	I	J	K	L
M	N	O	P	Q	R
S	T	U	V	W	X
Y	Z	0	1	2	3
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You can also display the complete list on one page

573 manufacturers in the database
Last site's regeneration : 3.06.2000 06:17 (GMT)
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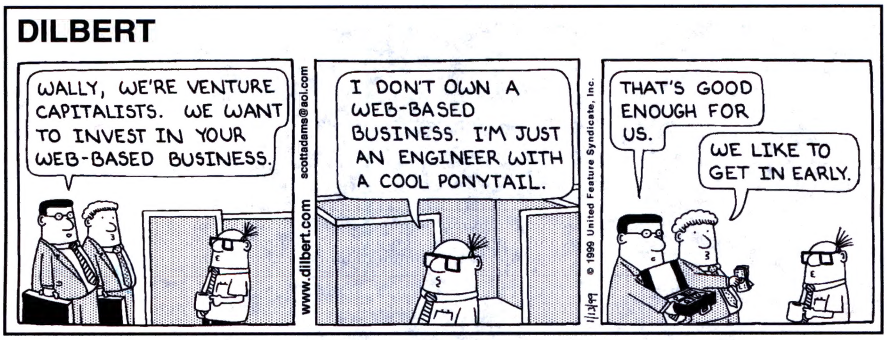

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LOOKING FOR MORE theory to delve into? Why not try the University of Washington's Electrical Engineering site. Not only does it have a few circuits for you to try, it also has some lecture notes on-line, including the theory behind magnetic recording and high-definition television. Point your browser to **http://www.ee.washington.edu/circuit_archive/index.html** for all the details.

NOW STRAIGHT FROM our 'it could only happen in America' file, if a week doesn't go by without your dose of *The X files*, you need to take a trip down the twilight zone at Information Unlimited **www.amazing1.com**. This place is full of eccentric electronics gadgets from the Rid-A-Way Rat Router to the 300,000-volt Sizzler stun gun. These guys are perfectly serious and while there's not much here by way of seriously useful stuff, it's always good to have a bit of a giggle now and then.

I DON'T NORMALLY give plugs to companies here but Rockby Electronics is a Melbourne-based operation that offer monthly specials that will make your mouth water... Well, if you call NE5532 op-amps for 30c each mouth-watering, head over to **www.rocom.com.au**. They have an on-line catalog and mail order so if your needs aren't being met by the big boys, why not give this mob a go? ■

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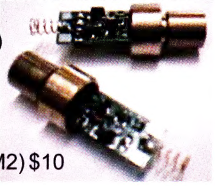

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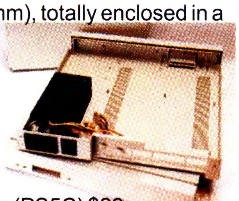

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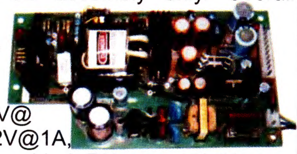

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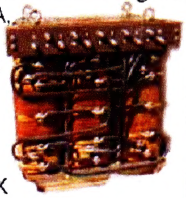

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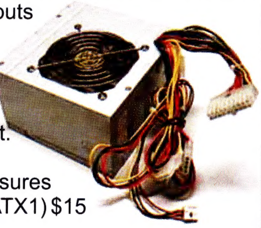

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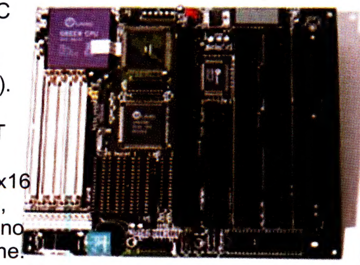

1MB 30pin RAM: This RAM is suitable for the 486 motherboard: $3 each or 4 for $10

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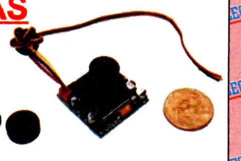

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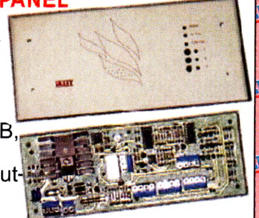

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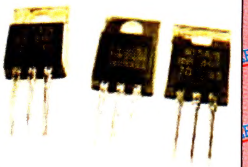

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